SCIENTIFIC AMERICAN

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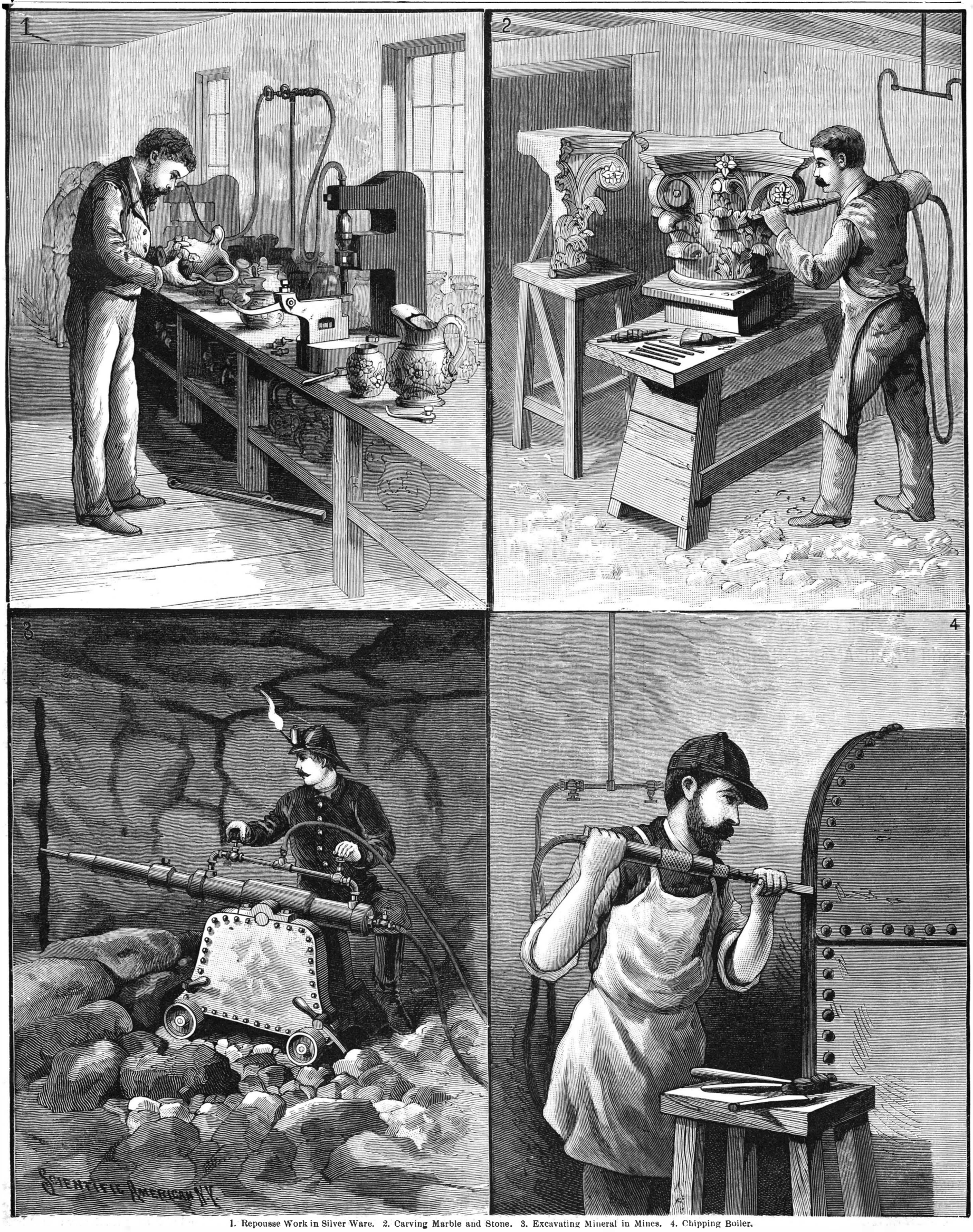

1. Repousse Work in Silver Ware. 2. Carving Marble and Stone. 3. Excavating Mineral in Mines. 4. Chipping Boiler.

THE MACCOY PNEUMATIC TOOL.—[See page 134.]

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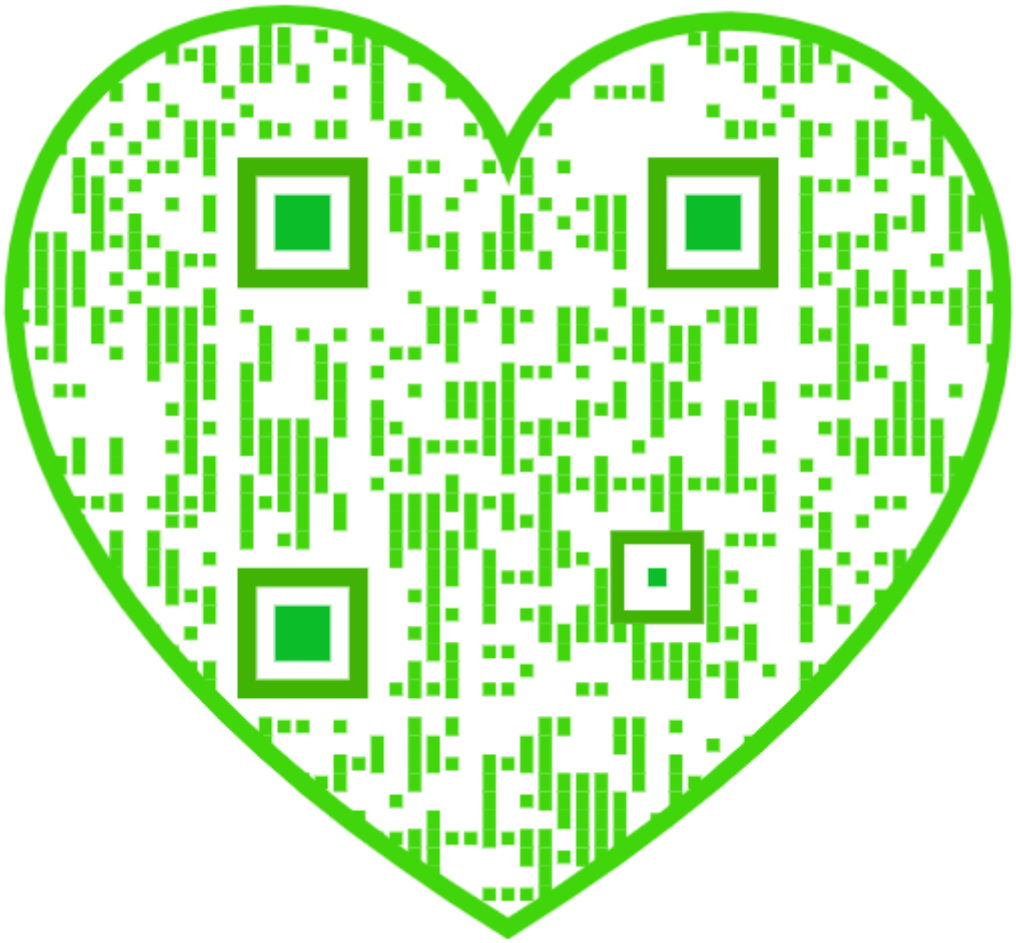

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GREAT WAR SHIPS.

A curious phase of the present controversy as to what constitutes the most effective war ship is that those who might reasonably be looked to to decide hold views differing widely, the one from the other. Doubtless the like has been noted in every radical change in construction and mode, both on the land and on the sea. Yet every recurrence brings fresh cause for astonishment. It is not, perhaps, far outstepping the bounds of accurate statement to aver that the older officers of navies are most likely to adhere closest to what has been.

It is only natural they should have confidence in the type of ship they are used to, and look with suspicion at the introduction of any other, save what may be regarded as but further development or reconstruction of the same. In the old days the broad pennant of an admiral flew in the tops of a great wooden line-of-battle ship with a broadside pierced like the side of a hospital; that could take a solid shot without disturbing the fiddler on the foc'sle, playing to the men swaying in the yards overhead. Now, however, the shot are heavier, with more driving power, and ships' sides are lowered as close as possible to the water line, so to diminish the target. So, too, the old time sea fight between the ponderous line-of-battle ships, though it should come again, would not avail to turn the scale of war. If the victor could not dominate the hostile coast before, he could not do it then. He would find the same heart within the belching of the shore batteries, the same enterprise and spirit animating the torpedo fleet. Hence the big sea fight would have been in vain, the destruction of costly material and, above all, of human life without excuse—aimless.

There are those, however, both here as well as abroad, who insist that we need such ships. Among them must be reckoned that distinguished old sailor, Rear-Admiral S. B. Luce, once commandant of the Naval Academy and author of the famous text book, "Luce's Seamanship." In a recent paper entitled "Our Future Navy," he insists that it is ships of this type, monster fighting ships with ponderous sides and batteries—all such ships have proved slow and unwieldy—that we are most in need of. He says: "The battle ship is the foundation of a navy. The United States has not one, and hence no navy!"

It is undoubtedly true that we have not any navy, but some excellent authorities have attributed this to the fact that our new cruisers were improperly constructed, and hence of no account, rather than to a lack of such craft as the admiral recommends. Indeed, in Great Britain, whose warship designing has become universal criteria, the chief constructor of the navy was recently compelled to resign because holding views similar to those Admiral Luce expresses in his paper. Through his influence the British navy was incumbered with a fleet of monster ships whose chief characteristics are an insatiate appetite for coal and an intolerable penchant for misbehaving in the seaway.

Quoting Admiral Luce once more:

"Let us now suppose the battle ships to be subtracted from the floating force of Great Britain. How long could she hold Gibraltar and Malta, control the Suez canal, and maintain her eastern empire by the eastern route? How long could she hold the line of London to Halifax, Esquimault and India, by the western? How long could she prevent Germany from establishing a military port on the Scheldt? How long could she hold the great strategic points, Jamaica, Barbadoes and St. Lucie, which dominate the West Indies, the Spanish Main and the Isthmian Canal, which will eventually open to her a short cut to the Pacific? Without battle ships, the whole British empire would crumble to pieces and, 'like the baseless fabric of a vision, . . . leave not a rack behind.'"

Some of the most eminent British naval authorities aver, and seriously, too, that the policy of attempting to protect these possessions by ships is a perilous one, sure to lead to disaster. If this policy should prevail, such monster line-of-battle ships as she has, answering the admiral's description, would be available only to guard the coast, and in that employment the circular floating battery, costing not a tithe as much, would be steadier, the puny torpedo boat perhaps more effective.

As to cruisers, such as those we have been building, Admiral Luce agrees with other first-rate authorities regarding their province, quoting the following sterling opinion of a recent Secretary of the Navy, who, though from this would seem to have been shown the right way, it did not avail him to steer the true course nor hit his port: "If slower than ironclads, she (a cruiser) could not keep the sea, and if slower than merchantmen, she might as well remain in port."

THE SITE FOR THE INTERNATIONAL EXPOSITION OF 1892.

On August 22 the Committee on Sites and Buildings for the International Exposition of 1892 held their first regular meeting at the City Hall in this city. The committee is a thoroughly representative one and it is certain that the work assigned them will be well done. At the first meeting little was done beyond the appointment of a chairman, Mr. Chas. A. Dana of the New York *Sun*, and the carrying of a motion to appoint an executive committee. The election of Mr. Dana as chairman gives general satisfaction. He has advocated the project for the exposition with great enthusiasm and contributed ten thousand dollars to the preliminary expenses. The availability of Central Park for a site came up, but the sense of the committee was almost unanimously against it, and it seems probable it will be selected. Still, there is a strong undercurrent among the citizens at large in favor of Central Park.

Mr. W. W. Astor, one of the members, expressed needs of the exposition very clearly. Two or three hundred acres of level ground clear of buildings and open to occupancy, free of cost, were stated as essential. The site should be on the water, available for ships as well as for rail cars. The position should be an attractive one and should look out upon a sheet of water for marine displays. These suggestions are excellent. The desirability of a water frontage is evident. The cost of delivering heavy machinery will be much reduced thereby, and from purely sentimental reasons New York should appear as a port, and her superb water environment should be a part of the exhibition.

It is too early to adopt definite views as to the proper locality. To benefit the city the exhibition should be held on Manhattan Island. As it stands now, the Riverside Park offers an excellent site. It overlooks the Hudson River, and is of ample area for the buildings. Its surface could be easily increased by carrying out an iron flooring over the steep banks of the river toward the bulkhead line, and locating the buildings on this floor. Just east of the park are the grounds of the asylum, and east of these comes the Morningside Park. The three could readily be united and made to assume, for the period of the exhibition, the character of a single park.

Visitors to the centennial of 1876 at Philadelphia have a vivid remembrance of the difficulties of transportation, the crowded trains and the impracticability of reaching the grounds except by two main routes. It would seem well within the limits of the question to place the exposition of 1892 upon Manhattan Island and within easy reach of all the city.

The suggestion of the Riverside Park opens up another possibility. The city of New York might purchase grounds for the purpose north of the park and bordering upon the river. There is a great need for the enlargement and extension of Riverside Park northward. The shore property between it and the northern limits of the island or even up to the city limits might be purchased and loaned to the exposition. When all was over the ground could be converted into a park in extension of the present one. The city of New York would then possess the most superb pleasure ground in the world. It would give her citizens a ramble or a drive of ten miles or more in length along the high and wooded banks of the Hudson, looking across the mile of water to the Palisades. It would seem a fitting conclusion to the exposition for the city to retain such a park as its memento.

Transparencies in Prussian Blue.

Mr. Robert Benecke, of St. Louis, gives instructions in *Anthony's Photographic Bulletin*, to select glass free from scratches and bubbles, put it in a solution of washing soda for a time, wash, and set it up to dry. Now take one ounce of fine gelatine, such as is used for making dry plates, put it in clean water, wash it a couple of times, squeeze out the water and place it on a clean towel. After about one hour, dissolve the gelatine in twenty ounces of hot water, and filter through cotton, flannel, silk, buckskin, or cotton pushed into the neck of a funnel. Coat the plates with the gelatine solution warmed from 120° to 140° Fah. In cold weather it will be necessary to warm the plates. When the solution is spread evenly over the glass, lay it on a cold marble slab placed horizontally, and as soon as the coating has become stiff enough not to run, set the plates up on nails to dry. This will take from eight to twelve hours or more. Any number of plates can be thus prepared, and may be kept for any length of time in a place free from dust. Next mix the sensitizing solution. Dissolve citrate of iron and ammonia 7½ drachms in 4 ounces of water, also ferricyanide of potassium 5 drachms in 4 ounces of water. Mix and filter into a dish, and immerse the plates about five minutes, avoiding air bubbles. This is better done in the evening by lamplight. Next morning they will be dry, and ready to be placed under the negative and exposed. The time for printing required is about double that for albumenized paper. The last thing to be done is the washing, which removes the salts and develops a rich blue print. The solution must be freshly made, as it will not keep very long after being used. The plates will keep in the dark for some time.

ERLEMEYER says that children born of women addicted to the morphine habit are practically morphine eaters from birth.

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POSITION OF THE PLANETS FOR SEPTEMBER.

JUPITER

is evening star. He stands first on the September annals, for he is not only the brightest star in the evening sky, but he is occulted by the moon under conditions favorable for observation. The occultation occurs on the 3d. The immersion takes place at 9 h. 51 m. P. M. Washington standard time. The occultation continues 48 m. The emersion takes place at 10 h. 39 m. P. M. As the moon travels from new to full, with her dark limb foremost, Jupiter will suddenly disappear behind her dark limb, as if he were blotted from the sky. Three of Jupiter's moons are, on the evening of the 3d, on the side toward the moon, and, if observed through the telescope, they will be seen to disappear one after the other before the moon hides the planet. The time of the occultation may vary as seen in New York, on account of the moon's parallax; but the difference will be slight. Jupiter sets on the 3d about 11 h. 30 m. P. M., so that he will be low in the southwest while the moon hides him from sight. Jupiter is in quadrature with the sun, being 90° east of him on the 22d, at 7 h. A. M. He is then on the meridian about sunset. Jupiter sets on the 1st at 11 h. 37 m. P. M. On the 30th he sets at 9 h. 51 m. P. M. His diameter on the 1st is 39″.2, and he is in the constellation Sagittarius.

SATURN

is morning star. A remarkable conjunction of Saturn and Mars occurs on the 20th, at 3 h. A. M. It is the closest conjunction of the two planets on astronomical records, Saturn being at the time only 1′ south of Mars, so that to the naked eye the planets will probably appear to coalesce. As the conjunction occurs very near the time when the planets rise, observers must look for them as soon as they are above the horizon. They must be looked for in the northeast, where the bright star Regulus, 4′ west and 45′ south of Saturn, will be a guide to point them out. There are two difficulties in the observation of this conjunction. The planets are too far from the earth and too near the horizon to be seen to advantage. The diameter of Mars is 4″, nearly invisible to the naked eye. Saturn's diameter is 15″.4, and he may more easily be found. An opera glass, or a small telescope, will however bring them both into the field. As Mars plunges into the Saturnian system he nearly occults one of the satellites, Japetus, passing only 12″ from it, at 5 h. A.M.

Saturn is in conjunction with Venus on the 26th, at 3 h. 18 m., being 34′ north. The conditions for observation are more favorable. The planets are higher above horizon, are easily visible, and Regulus is in close vicinity. The interval between them is a little greater than the diameter of the moon.

Saturn rises on the 1st at 4 h. 13 m. A. M. On the 30th he rises at 2 h. 37 m. A. M. His diameter on the 1st is 15″.4, and he is in the constellation Leo.

VENUS

is morning star. She is still fair to see as she makes her way nearer to the sun, her luster growing dim as she approaches the goal. Observers will note how near together are the planets Venus, Saturn, and Mars and the star Regulus during the month. Venus rises on the 1st at 2 h. 9 m. A. M. On the 30th, she rises at 3 h. 5 m. A. M. Her diameter on the 1st is 15″.2, and she is in the constellation Cancer.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 20th at 6 h. P. M., being then 26° 19′ east of the sun. Sharp-sighted observers may pick him up about the 20th, in the west after sunset, but he is too far south of the sun to be seen under favorable conditions. Mercury sets on the 1st at 7 h. 10 m. P. M. On the 30th, he sets at 6 h. 15 m. P. M. His diameter on the 1st is 5″.4, and he is in the constellation Virgo.

MARS

is morning star. He is slowly making his way toward us. His noteworthy conjunction with Saturn has already been referred to. Mars rises on the 1st at 3 h. 27 m. A. M. On the 30th, he rises at 3 h. 4 m. A. M. His diameter on the 1st is 4″.0, and he is in the constellation Leo.

URANUS

is evening star. He sets on the 1st at 8 h. 1 m. P. M. On the 30th, he sets at 6 h. 10 m. P. M. His diameter on the 1st is 3″.5, and he is in the constellation Virgo.

NEPTUNE

is morning star. He rises on the 1st at 10 h. 10 m. P. M. On the 30th, he rises at 8 h. 17 m. P. M. His diameter on the 1st is 2″.6, and he is in the constellation Taurus.

Venus, Mars, Saturn, and Neptune are morning stars at the close of the month. Uranus, Mercury, and Jupiter are evening stars.

FROM experiments made in Richmond, Va., with electric heaters, it seems probable that a passenger coach can be kept warm at an expense of two cents an hour, the current being supplied by a dynamo on the locomotive or tender.

[GOOD HOUSEKEEPING.]

Cuffs, Collars, and Shirts.

How many a young wife has viewed with "weariness and vexation of spirit" her husband's linen, limp, damp, and streaked with bluing, feeling she either had to put up with it—rather allow him to do it—or force him to drop his hard-earned dollars in the almost indispensable steam laundry, in order to show a bold white front to the wearisome toil of the day. I, among the rest, have suffered at the hands of ignorant, unscrupulous laundresses with their pockets full of sal-soda, etc., who, when mildly rebuked for their execrable washing, tell you with an injured air, they do their best and if you don't like it, better get some one else.

Many a girl on the eve of her wedding knows as little about "doing up" a shirt as she does about making bread, which is precious little, for she has never had to do it, was never made to do it, and how can she show any willing woman in her employ how to do it, if she knows not how herself? After weeks, yea! months, of bad washing, she finally concludes it would be economy to send the cuffs, collars, and shirts, anyhow, to the laundry, or take them to the nearest Mongolian to be spat upon, thinking she will save on something else.

All goes well for awhile, but our young friend soon discovers the shirts wear out much sooner than usual, the cuffs are not mated, and very often her husband goes down to his office in a bad humor, the result of finding all his collars marked 17 inches, when he wears a 15½. But the comfort of having them look white and stiff shuts her eyes to the price and loss, which amounts to considerable to a young couple, perhaps with a growing family and limited means.

For those in sympathy with me and who are now going through the mill, let me solve the problem, or, in other words, give them the benefit of the advice of an expert laundress, recently employed by my mother, who by accident engaged her, not knowing at the time her true worth, nor her amiable willingness to show and tell how she put iron in the bosoms and luster on the linen. The woman in question was a bright mulatto, who worked as she talked with an ease and grace that bespoke her ability to practice what she preached.

This is her way, and as I am only alluding to cuffs, collars, and shirts, the supposition is that they are snowy white when you go to starch them. The starch for these articles is made much thicker than ordinary, so that when it is cold you can slice it with a knife. For those who have never made it, I append the following recipe, enough for four shirts, a dozen collars, and as many pairs of cuffs: Put to boil in a clean saucepan with copper bottom one and one-half quarts of clear water; have ready a cupful of best gloss starch dissolved in cold water, and when the water on the stove is galloping, for it must "dance as well as sing," pour in the melted starch, stirring well, and boil carefully until it is translucent. It must be quite thick, and if one cupful (as cups vary) is not enough, dissolve more and add, being careful not to let it burn. Fifteen to twenty minutes boiling I find sufficient, and it is ready to strain in three-cornered cheese cloth bag, which you will find better than thicker goods, as the starch runs through it readily. Now add a teaspoonful of kerosene and a few drops of bluing. Some use a bit of butter or sperm, but I find kerosene to answer the purpose and is always at hand.

The starch made and the clothes ready, you may now proceed to business. Don't be in a hurry, for what time you consume in the starching will be made up in the ironing. As soon as the starch is sufficiently cool to bear your hand, take a shirt that has just come from the rinse water, gather up the bosom, immerse in the starch, rub well, long, and vigorously till the starch has entered every fold of the bosom, lining and all; don't wring or squeeze, but draw it through your fingers well, slipping off all superfluous starch; treat band and wristbands the same, hang up until bone dry. Proceed to do the same to the collars and cuffs, not forgetting that success in the ironing depends wholly upon how well you rub in the starch. In stripping them of the starch, endeavor to smooth out all wrinkles while wet, and when dry they will rattle like paper.

If the ironing does not take place until the next day, put your linen away carefully out of the dust, but do not sprinkle. A half hour before you are ready to iron it, wring out of cold water very dry a clean white cotton rag twice the size of a towel, lay the collars and cuffs on it, with the fold of the rag between each article, roll up smoothly and tight. On the shirt bosoms lay a similar rag, only smaller, enough to cover the starched parts, roll as before and put away for thirty minutes. Heat on the fire three polishing irons, which are oblong in shape with rounded corners. The ones I have are called the "Detroit," and have a corrugated surface, which adds much in obtaining that luster so envied in well laundried linen. In using them at first they seem very awkward, being easily turned over, but a little attention and practice will enable you to use them with dexterity and effect.

When the time is up, take one article at a time, lay on a clean white ironing board. See that your hands are immaculate and your irons clean; rub the latter on brown paper and a bit of beeswax, then on a clean rag. If your polisher is at the right heat, it would only take a few firm rubs up and down on each side to make you feel proud of your collars and cuffs. The shirt bosoms are drawn out smoothly on a bosom board, after ironing the sleeves and tail, also the neck and wristbands. Now grasp the neck with your left hand and slide, as it were, your iron up the middle, sending all wrinkles to the sides instead of the top or bottom. Press firmly, curve around the neck band, so that it will stand, put a pin in it to preserve its shape, fold, and your work is done. Don't be discouraged by your first failure. The results are worth the trial, and you will soon find yourself competent to teach your next new laundress, bearing in mind that the ironing is the least part of the work, and that success depends upon white clothes and thorough starching.

My husband, father, and brothers no longer help to support John Chinaman or his great contemporary, the steam laundry, but revel in linen as stiff as ivory and white as snow, which is as great a pleasure to them as it is comfort to me. MRS. H. V. P. TAYLOR.

Celluloid.

Now there seems to be every probability of glass being, at least partially, superseded by celluloid in negative work, especially out of doors, we may expect soon to find a new subject for discussion in the question as to whether the substance referred to is altogether free from faults in its new application. It may be said, indeed, that the question has already been raised.

If it should be proved that these doubts are well founded, the question suggests itself as to whether the beautiful substance cannot in some way be freed from its baneful ingredients. In other words, whether it cannot be *decamphorated* and *denitrated* without destroying it advantageous features, especially its transparency and flexibilty.

With a view of testing the possibility of this we have made a few rough experiments, but not with any very decisive result, at any rate so far as success is concerned, but rather the opposite. With a view of removing, if possible, the camphor, a sheet of celluloid was digested with ordinary methylated alcohol, which, though at first producing no apparent result, was found in the course of a few hours to have *completely* dissolved it. Here, then, there is no possibility of dissolving out the camphor, since the latter lends its aid to the alcohol in dissolving the pyroxyline.

Another sheet accurately weighed (like the last) was submitted to the heat of about 180° Fahr. in a gas oven for a period of twelve hours; at the end of that time it was physically changed to the extent of being badly curled and crumpled by the heat, though that might possibly be remedied by proper precautions. But the loss in weight after twelve hours "stoving" did not amount to *one tenth of one per cent* on the total weight. So here, again, there does not appear much hope of driving off the camphor in vapor without hopelessly spoiling the material.

Of a number of experiments in denitrating, one may be specially mentioned. If the celluloid be immersed in strong concentrated sulphuric acid, no apparent action takes place; but if an equal volume of water be added, the sudden and intense heat evolved causes a deep yellow coloration of both celluloid and liquid, and the evolution of a powerful empyreumatic, mixed up with which camphor is plainly recognizable. After a very short time the action ceases and the color leaves the solution.

If the celluloid be now taken out, washed, and dried, it will be found to have lost considerably in weight and to have had its surface eaten away irregularly, or corroded in much the same way as glass when treated with dilute hydrofluoric acid. Returned to the dilute sulphuric acid and boiled, no further action takes place until ebullition has gone on for some time, when the liquid commences to turn yellow, but the color at first quickly disappears on stirring. Gradually, however, it becomes stronger and more persistent, and at the same time strong nitrous fumes are given off, these being apparently the cause of the yellowing. Finally, the color becomes brown, and the celluloid dissolves entirely, forming a deep brown solution.

Now this seems to prove that *as celluloid* the substance for a long time resists even boiling sulphuric acid, but gradually it is denitrated, and then *as cellulose* is carbonized and destroyed by the acid. Thus the possibility of denitration is proved, but whether it can be done practically without destruction is a question.

If this can be accomplished, one at least of the possible weak points in celluloid will be removed.—*Br. Jour.*

A SYSTEM of building houses entirely of sheet iron has been communicated to the Society of Architecture in Paris. The walls, partitions, roofs, and wainscoting are composed of double metallic sheets, separated by an air mattress, which is surrounded by different non-conductors of heat.

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SPIDER WEB AND COCOON MAKING.

MRS. NICOLAS PIKE.

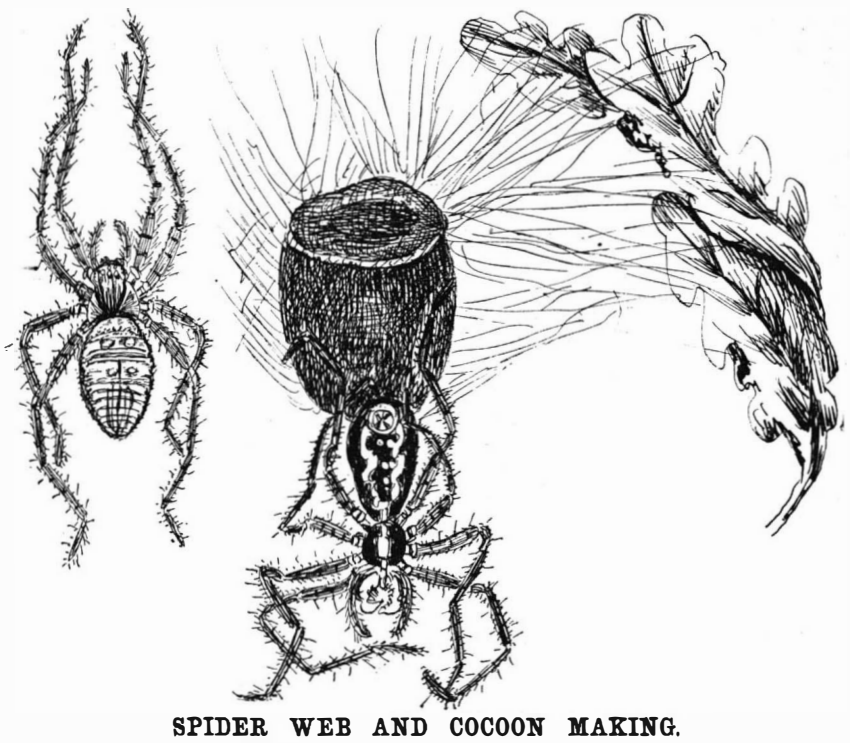
Every one who has visited the borders of creeks and marshes for flowers or insects, generally abundant in such localities, must have noticed the webs of bright colored spiders, suspended between tufts of grass and bushes, with their owners on or near them. Peculiarly notable is the *Argiope riparia* (Hentz.), from its jet-black, humped abdomen partially covered with golden-yellow markings. Naturally the web of so large a spider is very strong, and very capable is my lady of earning a good living from it. Often a great blundering cockchafer, locust, or butterfly comes along and would soon play havoc with the lace-like fabric; but there is a clever arrangement attached to the web on purpose for such an emergency. A long zigzag composed of a great number of white threads traverses the web for two-thirds of its length, looking as if the owner had been neatly darning it. Like the Fates she works in secret, being Lachesis and Atropos all in one. Say a beetle whirrs along, and catches his feet in the web; with a rush she is on him, cuts loose her zigzag, winds it around him, folds back his wings, and utterly disables him. She then coolly hangs him up for her next meal, when she has repaired damages and spun a new winding sheet for her next victim.

One day I brought home a fine riparia and put her in the ivy twining round my windows, and she soon made herself at home. Next morning she spun a fine web covering everything in the window with a long zigzag and a fluffy nest, where she lay concealed. I had to break up her web to open the shutter, which roused her ire, and she rushed round furiously, only appeased when she pounced on a bluebottle fly for her breakfast. The next day she had made a new web a little higher up, but not clear of the shutter, so that it had to be destroyed; but on the third morning she gauged her distances so cleverly out of the way of the shutter that she was never interfered with after. A new web was spun every day, but in about a week she ceased making a large zigzag, only spinning a few threads, as she found her prey only consisted of small houseflies or moths. What a wonderful adaptability to circumstances the little creature displayed! How well she learned her lesson! Surely this showed not instinct alone, but intelligence and forethought.

One morning I was down very early and I found my spider busy *scrabbling up* (I can use no other term) the old web, and whether she swallowed it, as they say she does, I know not; but it vanished.* I was occupied for a short time, and when I returned she had laid the ribs of her web, if I may so call them, and spun a few circles in the center. She had become so tame from constantly feeding her that she allowed me to watch her closely, and see a geometric web fabricated. The quick, exquisite way she spun circle on circle, so true and perfect, was a sight to be remembered. As a line was drawn from the spinnarets she caught it up with a hind claw and made an elaborate knot on each rib, till one could fancy hearing the click as it slipped into place. The knot or catch was formed so rapidly it was impossible to see just how she twisted the thread round the rib; but each line was carefully tightened before the next one was drawn out. Occasionally she turned back and made a second line between two ribs. Possibly she saw some defect in the first she wished to strengthen. I was called away, so that I did not see the zigzag made; but I saw her sending out dozens of guys to sustain the web, and covering over an ivy leaf for her retreat, neither of which was made as delicately or carefully as the circular part. I did not see the operation of making her cocoon, but my husband did and gave me his notes as follows:

"The riparia left her web in the ivy and spun innumerable threads in the angle of the wall near by. When sufficient for strength were run out, in the center of them she wove a close, thick horizontal web, about one and a half inches in diameter, of the finest texture. On this she deposited her eggs and then drew the whole together till it was like a fluffy ball. Over the whole she spun a thick covering till it assumed the well known pear shape, and on exposure to the air it soon changed from white to brown in color. The narrow end is to hang it up by, and she did not leave it till it was fastened very securely. She remained near, watching the cocoon, which I took down in the course of the day, and, to my surprise, in the following night she wove a second cocoon as large as the first."

A second spider, not so large but nearly as noticeable as the riparia, from the silver sheen all over it and the yellow legs black-barred, inhabits the same localities and spins a similar web—the *Argiope transversa*. Oc-



SPIDER WEB AND COCOON MAKING.

tober 22, 1887, I took a fine female and placed her in a glass-fronted box, in which I put a few half-dried leaves. As I am not aware that the method of making the cocoon of the transversa has ever been observed (certainly it is not described as yet), I will give my experience, which was a very pleasurable one. About 8 A. M., on the morning after I brought her home, I went to look at her, and found she had laid a cluster of dark yellow eggs on the bottom of the box, and was busily working on her cocoon. It was egg-shaped below, and looked as if broken off at the top, pure white, and of the thinnest texture. She was evidently beginning to strengthen the cocoon. She drew out threads from all her spinnarets at once, uniting them with her hind feet, first one and then the other, going round and round till the whole was of uniform thickness, and then added extra guys to the leaves and glass front of the box. About 10 o'clock she seemed perfectly exhausted, and she hung herself up by her hind feet on the cocoon, the other legs dangling limp in all directions. (See plate.) She remained thus for about an hour, during which time the color of her work changed from white to a pinkish stone. At last she raised herself wearily and crawled up to the web at the top of her cocoon. At this juncture I had to leave for a short time, and when I came back the eggs had vanished. So I presume she had lifted them into their nest, probably with her powerful mandibles, as she was hastily weaving a thick covering all over the top. Then the tired mother patiently began a new work. Not content with all the guys already spun, she traveled back and forth hundreds of times till she had drawn the two leaves close over her cocoon and bound them fast to it. Unlike the riparia, she refused food, and soon after died.

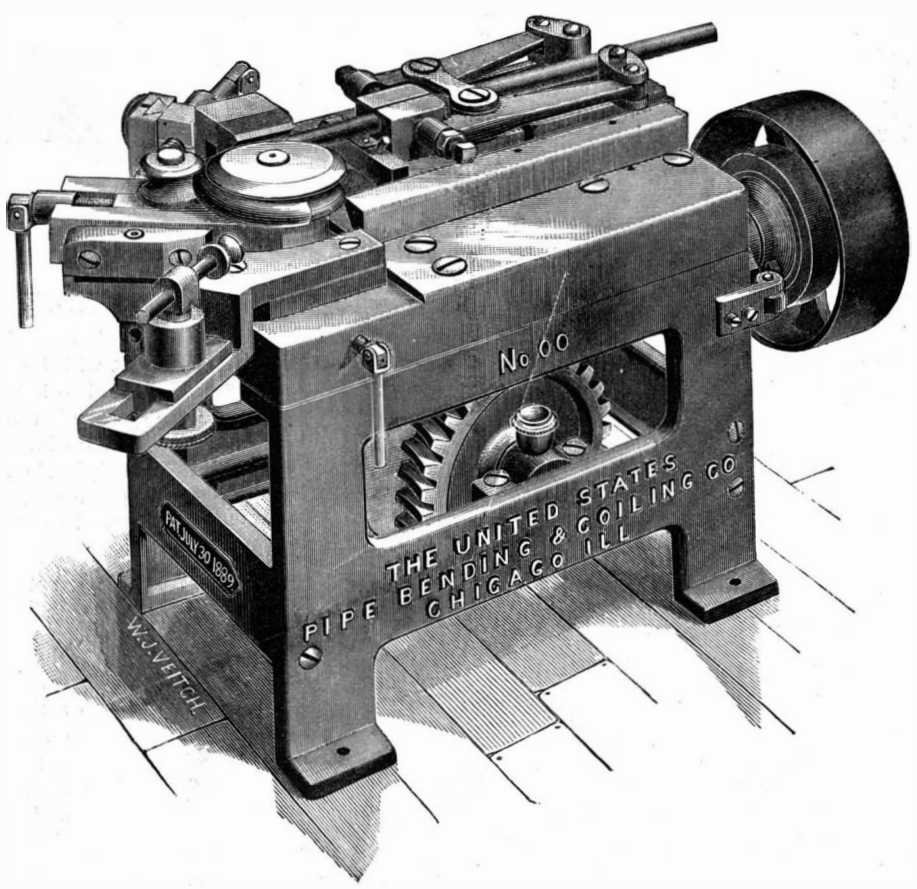
*Some think she makes it into little balls and throws them away.

A Substitute for Glass.

The new translucent substance intended as a substitute for glass has been adopted for some months in some of the public buildings of London, and various advantages are claimed for it, among these being such a degree of pliancy that it may be bent backward and forward like leather, and be subjected to very considerable tensile strain with impunity, it is also almost as transparent as glass, and of a pleasant amber color, varying in shade from very light golden to pale brown. The basis of the material is a web of fine iron wire, with warp and weft threads about one-twelfth of an inch apart, this being inclosed, like a fly in amber, in a sheet of translucent varnish, of which the base is linseed oil. There is no resin or gum in this varnish and, once having become dry, it is capable of standing heat and damp without undergoing any change, neither hardening nor becoming sticky. Briefly, the manufacture is accomplished by dipping the sheets edgewise into deep tanks of varnish, and then allowing the coating which they thus receive to dry in a warm atmosphere. It requires somewhat more than a dozen of these dips to bring the sheets to the required degree of thickness, and, when this has been accomplished, the material is stored for several weeks to thoroughly set. This fabric might be worth testing for those parts of studios through which a subdued light only is desired. As the substance contains no resin and is practically solidified balloon varnish, there may be hopes of comparative durability. —*Photo. News.*

AN IMPROVED MACHINE FOR BENDING AND COILING PIPE.

The accompanying illustration represents a machine adapted to bend, coil, or cone pipe, in any shape desired, without either heating or filling it, the pipe being actually improved in condition by being subjected to the cold-rolling operation of the machine. The pipe is fed through dies shown in the illustration, and thence through and around circular dies, the machine being adapted to bend either the heaviest wrought iron pipe or the lightest brass and copper pipe with perfect accuracy as regards the size of bends wanted or the diameter or spacing of the coils. Any number of a particular coil, as regards diameter or spacing, can be made at the rate of three feet a minute after the machine has been adjusted to the size wanted. The machine is simple in construction, having comparatively few parts, which are very strongly made. With its use there is no scale made on the inside of the pipe, which is always an accompaniment of hot bending, and with brass or copper pipe no refinishing is required after the pipe has passed through the machine. Any length of pipe can be bent or coiled by the machine, its capacity in that respect being limited only by the longest pipe the manufacturer can supply or the space permitted for handling. This machine is especially calculated to meet the wants of manufacturers of coil boilers, feed water heaters, car heaters, plumbers' goods, gas and electric light fixtures, and of those fitting up apparatus for making artificial ice and for cold storage, and for distilleries of all kinds. It is to be manufactured and leased to consumers on long leases by the United States Pipe Bending and Coiling Co., of No. 115 Dearborn Street, Chicago, Ill., D. T. Hedges, president; J. B. Hughes, vice-president and general manager; Wm. J. McMullen, secretary; and Malcom M. Jamieson, treasurer.



FOWLER'S PIPE BENDING AND COILING MACHINE.

The company have also fitted up a place in New Haven, Conn., where the machine will be exhibited for the benefit of Eastern manufacturers.

THE lamp experimented with in France, to be used on the battlefield to search for the killed and wounded, is about the size of a locomotive headlight. It has a powerful reflector, and the light is produced by the combustion of two magnesium wires.

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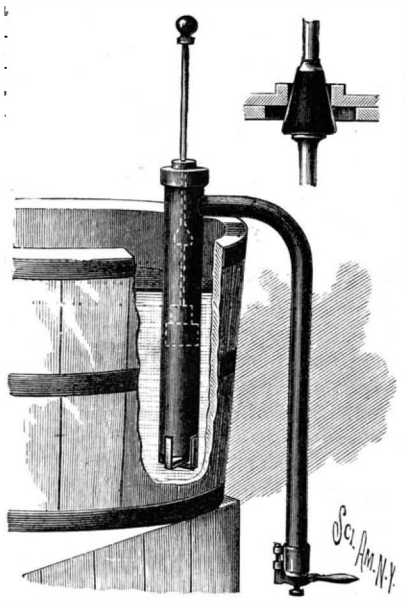
AN IMPROVED SIPHON.

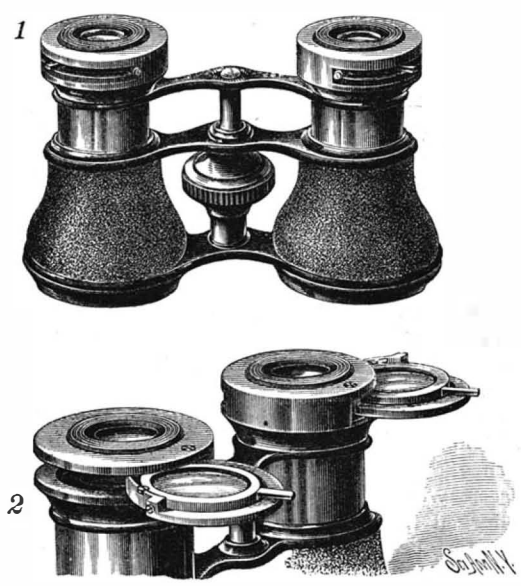
A siphon adapted to facilitate the emptying of tanks, vats, etc., and one which can be readily charged and easily kept clean, is illustrated herewith, and has been patented by Mr. Leopold Meyer, of Ahnapee, Wis. In the short leg of the siphon is a piston, provided with a flap valve, this piston having a stem which extends outward through a cap, a packing ring being interposed between the upper edge of the leg and the under surface of the cap, as shown in the small view, while the stem also carries a conical packing ring. The long leg of the siphon carries an outer gate or valve of ordinary construction, and, to facilitate the pumping action, a flap valve is mounted in the lower end of the short leg, which is also provided with a short supporting frame on which it rests close to the bottom of the tank or vat. As soon as the liquid is made to flow out through the cap, by working the piston, the stem is raised until the packing ring thereon closes the opening, when the liquid will descend through the long leg of the siphon, and the stream will be maintained until the contents of the vat have been drawn off. The siphon may be readily cleaned by pumping water through it after each use.



MEYER'S SIPHON.

ASTIGMATIC EYEPIECE FOE OPTICAL INSTRUMENTS.

It is a remarkable fact, not generally known to persons unacquainted with the business of the oculist or optician, that fully one-half of the people who wear glasses are troubled with astigmatism, a defect of vision caused by difference of refraction in the horizontal and vertical meridian of the observer's eye. Persons having this defect of vision see objects distorted in a horizontal or vertical direction, or at some intermediate angle. The lenses of the eyes of such persons, although approximately spherical, are slightly cylindrical.



ASTIGMATIC EYEPIECE FOR OPTICAL INSTRUMENTS.

To correct this defect, eyeglasses are made in the form of a segment of a cylinder upon one side, and upon the other either entirely plane or spherical or concave, according to the requirements of the case. The cylindrical surface may be either convex or concave, according as to whether the patient is near or far sighted.

Persons seriously affected with astigmatism have heretofore been unable to use telescopes, opera glasses, microscopes, or the class of engineering instruments employing telescopes. Recently, however, a patent has been taken out by Messrs. Joseph Kornblum, John A. Brashear, and Park Painter, for astigmatic eyepieces for optical instruments, which effectually corrects all astigmatism in all instruments to which it is applied. Mr. Kornblum is a practical optician of high standing, who studied the subject thoroughly in Europe, and has had a practice of over 20 years in this country; Mr. John A. Brashear is the well known astronomer and astronomical instrument maker of Pittsburg, Pa.; and these gentlemen, together with Mr. Park Painter, the prominent iron manufacturer and capitalist of Pittsburg, Dr. J. A. Lippincott, and Mr. Ross W. Drum, cashier of the Traders' National Bank, Pittsburg, have associated themselves in a stock company for promoting this invention.

Mr. Kornblum informs us that within the last 14 years he has filled over 28,000 prescriptions for astigmatic glasses from Dr. J. A. Lippincott, the eminent oculist of Pittsburg. This great number indicates the prevalence of this visual defect.

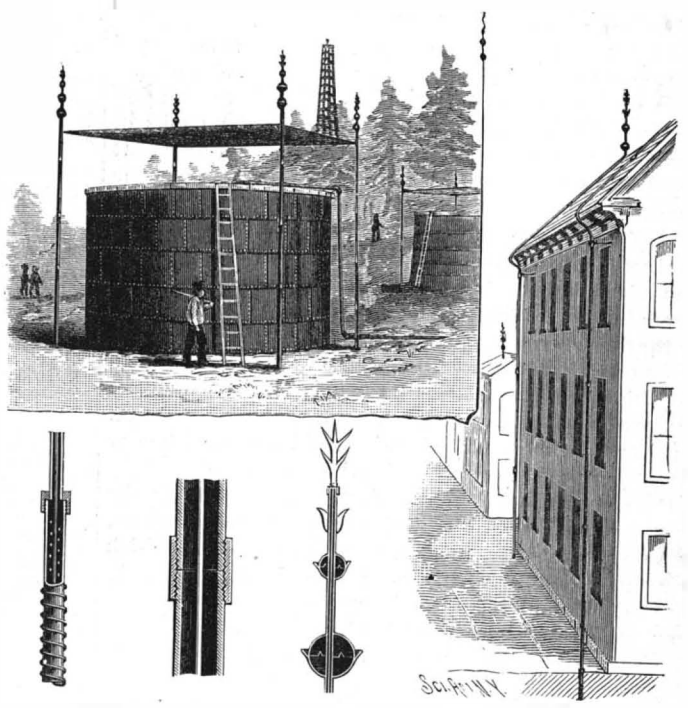
Although this improvement applies to almost every kind of optical instrument, it will be here described in its application to an ordinary opera glass, as shown in the engraving, Fig. 1 being a perspective view of the opera glass, Fig. 2 being an enlarged perspective view of the eye end of the glass, showing the details of the improvement.

The improvement consists in applying to each eye lens cell an extension in which is pivoted a frame containing a ring, which in the present case is made revoluble, and arranging in these rings auxiliary lenses of cylindrical form adapted to compensate for the cylindrical curvature of the eye lens. These lenses are especially fitted to each case, and when once arranged at the proper angle they are secured so that they rest in a pivoted frame, but they may be swung out of the field of vision, as shown in Fig. 2, so that the opera glass may be used like any other by a person having normal eyesight. This improvement will open a new field of vision to persons who have heretofore been unable to view objects through the telescope, microscope, opera glass, or similar optical instruments.

Further information in regard to this invention may be obtained by applying to Mr. Joseph Kornblum, 50 Fifth Avenue, Pittsburg, Pa.

A SYSTEM OF PROTECTION FROM LIGHTNING.

The accompanying illustration represents an improved form of lightning rod and a system for protecting oil tanks and receivers of inflammable or explosive substances from lightning, which form the subject of two patents issued to Mr. Chas. F. Hill, of Hazleton, Pa. The rod is made tubular in form, with an internal conductor, and, in order to secure embedding of the conductor in moist earth, there are placed upon the rod, near its upper end, below the finial, water-collecting vessels, as shown in one of the small views, which are in communication with the interior of the tube. They are designed to collect the rain, dew, or other moisture, and convey it directly to the embedded lower end of the rod, from which it can escape at the end and through lateral perforations. Each of the tubular rods may be made of sections of galvanized gas-pipe, coupled, as shown in the sectional view, another view also showing the conductor coiled around the lower end of the tubular rod as it is inserted in the ground. In order to protect an oil tank, the atmosphere surrounding which is often charged with inflammable vapor, a number of these rods, in the form of tubular metallic poles, are placed around the tank, and connected by conductors crossing above the tank with the conductors in the rods. Another conductor also passes horizontally from one pole to another around the tank, and is connected with the conductors which cross above the tank, the latter conductors being electrically connected by soldering where they cross or lap each other. To further divert and neutralize a stoke of lightning, a metallic net is arranged some distance above the tank, the net being of greater area than the diameter of the tank, and being secured to and supported by the several conductors and the poles. This method of protection is intended to completely take up any electrical discharge from a storm cloud toward an oil tank, and carry such discharge harmlessly to the earth, and it is claimed that its general adoption will largely diminish the great annual loss suffered from oil tanks being struck by lightning.



HILL'S LIGHTNING ROD AND PROTECTOR FOR OIL TANKS.

The Secret of Aerial Travel.

Referring to the sad fate of Professor Hogan, who lost his life in attempting to navigate the Campbell aerial vessel, illustrated in these columns a few weeks ago, some one says:

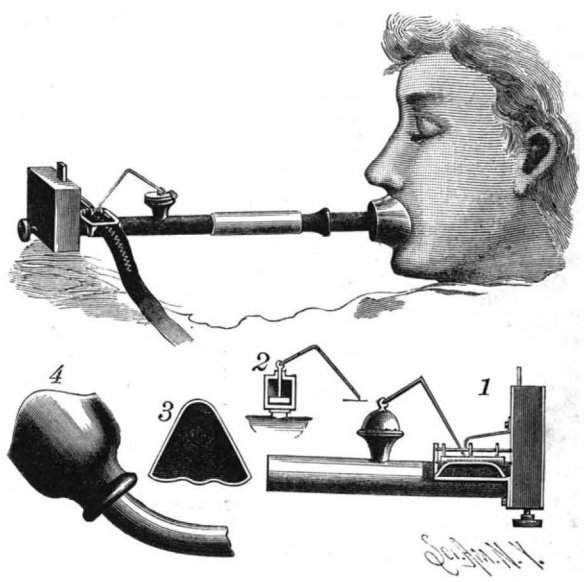
When human ingenuity can match the product of nature; when it can make a machine possessing as much power and endurance to the ounce of weight as that of the homing pigeon which lately flew from Detroit to Buffalo (225 miles) in less than four hours; when it can so arrange and automatically shift a series of vanes like shifting feathers in a hawk's wings, which suspend it in the air for hours almost without apparent motion, when it can solve the problem of how this same hawk drops like a bullet from the dizzying height of a half mile, and checks itself unharmed above its prey, then it may learn to travel in the air.

ENGLISH authorities have concluded that dynamic cooling, if not the sole cause of rain, is, at all events, the only cause of any importance, all other causes being either inoperative or relatively insignificant.

AN APPARATUS FOR RECORDING RESPIRATIONS.

The accompanying illustration represents an apparatus for indicating and recording the respirations of the body, which has been patented by Mr. Khurshed M. Tata, of Navsari, near Bombay, India. The object sought is obtained by placing one end of a tube over the nose or mouth of the person whose respirations are to be measured or recorded, the other end of the tube having a valve susceptible to slight movements of the air, or a membranous or other diaphragm to which light breathing will impart motion, the valve or diaphragm having a needle or pointer, to indicate, measure, or record the number or strength of the respirations.

The tube consists of a central section of rubber or other elastic material, with a widened end section of papier mache or similar substance, to which is attached a mouth or nose piece, the latter being partly shown in Fig. 3. The nose and mouth piece are interchangeably applied on the tube as desired, Fig. 4 showing one form of attachment. The outer end section of the tube is constructed preferably of metal, and from its upper surface a short tube is projected having a hinged gravity valve acted upon by the breath of the patient. A bent or angled needle is pivoted to this valve, the end of the needle being adapted to puncture small holes in a traveling slip of paper, or to trace a line on the paper. The paper is carried by rollers and a spindle operated by mechanism in a case at the end of the tube, a mainspring and a train of wheels affording a simple form of such mechanism. A modified form of the instrument is shown in Fig. 1, by which both the inspirations and expirations will be indicated, the valve tube being in this case closed by a bag-shaped diaphragm, which will alternately be blown out and drawn into the tube. This diaphragm has a needle passing vertically through its center, to which the bent or angled tracing needle is loosely pivoted. In Fig. 2 the place of the valve is taken by a piston sliding within a cylinder, the tracing needle being attached to the piston rod. A thermometer may also be placed in the tube, with its bulb in contact with the air in such a way that the temperature of the breath may be read off from the outside of the tube.



TATA'S RESPIRAGRAPH.

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The Cigarette Doomed.

Observation in public places gives satisfactory evidence that the use of cigarettes is rapidly on the decline. Whether this is due to the stringent laws passed in many of the States against selling them to minors, or that smokers have come to their senses and have taken warning from their own experience and the unanimous condemnation of smoking cigarettes by the medical profession, or whether the evil practice has begun to be looked upon as a discreditable vice to be only practiced in secret, we know not; but it is certain that, as compared with the past, very few cigarettes are now smoked in public. Cigar dealers say that the sales of cigarettes have fallen off enormously. The manufacturers of these noxious things have been compelled to advertise largely to prevent the entire destruction of their business, and about the only people who can now be seen smoking the paper abominations are a few moon-faced juveniles who imagine that cigarette smoking gives them a literary aspect, or who ambitiously aim at appearing manly and graceful while poisoning the atmosphere about them, or blowing the offensive smoke through the windows of horse cars until rebuked by the conductors. Employers and business men generally have arrayed themselves in opposition to those who persist in the objectionable practice, and young ladies have learned to understand that the real reason why their young men smoke cigarettes is that they can smoke twenty of them, vile though they are, for the price of a very cheap cigar. It will be well for our youth when the habit becomes wholly extinct. Dr. William L. Dudley, Professor of Chemistry in the Vanderbilt University, gives the results of recent careful analytical experiments made by him in his laboratory with the smoke of an ordinary cigarette. The tests were thoroughly scientific and conclusive. The fact was demonstrated beyond the chance of doubt or question that carbonic oxide is the chief constituent of cigarette smoke, if not all tobacco smoke, and that its inhalation into the air passages and lungs must, of necessity, be exceedingly deleterious. Prof. Dudley refers to published assertions that the adulteration of tobacco with opium and flavoring drugs, and the alleged presence of arsenic in the paper, are the chief causes of the evil effects of cigarette smoking, but pronounces them unsatisfactory and insufficient as explanations. His chemical tests, he insists, have demonstrated positively the actual cause of the mischief, namely, the cigarette smoker's absorption of the carbonic oxide and other gases, causing deoxidation of the blood, and thereby impairing its power to build up the wasting tissues of the body. The cigarette habit has of late years become very common in this country. It is one of those many European importations which do our people more harm than good. Many of our young men, and some of them are neither young nor inexperienced, are literally burning out of themselves the best element of their manhood by sucking into their systems the poison of physical and mental degeneracy through the filthy cigarette. Cigar smoking and pipe smoking are bad enough and pernicious enough in all conscience, but cigarette smoking is absolutely suicidal.—*Amer. Analyst.*

Orbital Motion of Sun and Stars.

Concerning the theory that the sun is revolving as a planet around some star in obedience to the Newtonian law of gravity, it may be pointed out that a star at the distance of the nearest known fixed star, having a mass equal to the sun's, would, basing calculations upon certain masses and distances given in text books of astronomy, attract the sun with a force equal to about $\frac{1}{3873}$ that of the sun's attraction for Neptune. At the average distance of stars of the first magnitude, the controlling star would need to have a diameter equal to thirty-eight times that of the sun, assuming equal densities for both bodies, with a corresponding mass, to enable it to attract the sun with a force equal only to that necessary for the sun to exert to hold Neptune in its orbit. And if we go one step further and multiply this augmented mass by the number by which the sun exceeds Neptune in mass, a proceeding consistent with the theory in question, it would have a diameter approaching that of Jupiter's orbit.

If a spherical shell be conceived concentric with the supposed governing star and passing through the sun, it would probably inclose other stars, all of which together, possibly with some stars without the shell, must also be moving with the sun around the central star, otherwise there would be apparently an entangling of systems dangerous to many suns.

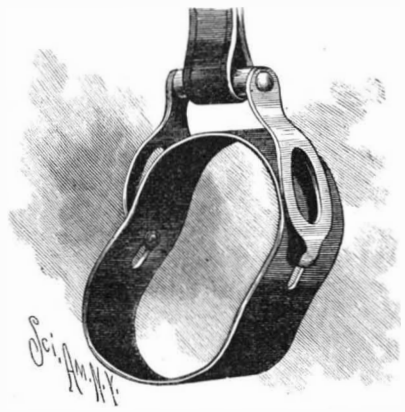
E. B. WHITMORE.

Rochester, N. Y.

We do not wonder that Mr. Whitmore finds difficulty in accepting the theory of orbits for the sun and stars, which he seems to have thought upon carefully and well, and which is advanced in elementary text books on astronomy. Late astronomy does not sustain that theory. There are no proofs that the motion of the sun or stars is orbital, when independently considered, except in the case of multiple stars, and, possibly, some clusters of stars. Every star attracts every other according to a well-known law, and hence individual stars must obey all these separate forces drawing one another with varying intensities at the same time in all possible directions. Hence the path of any star in space cannot follow the law of any known curve, neither can it be an absolute straight line. The probabilities of the case are that their motions are irregular and widely dissimilar.—*Sidereal Messenger.*

AN IMPROVED REVERSIBLE SAFETY STIRRUP.

A stirrup in which the foot of the user is not liable to catch in case of accident, and the top of the bow or ring will not bear against the ankle of the user, while the ring or bow may be reversed at will, is shown in the accompanying illustration, and has been patented by



WELCOME'S REVERSIBLE SAFETY STIRRUP.

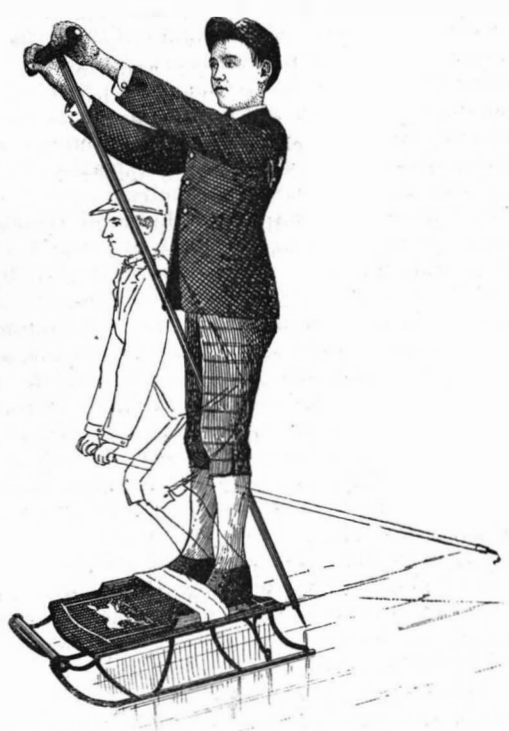
Mr. Jacob C. Welcome, of Burns, Oregon. The upper ends of the arms of the yoke are connected by a bolt, and spaced by a sleeve or washer, through the axis of which the bolt passes, and which is encircled by the stirrup leather. The arms spread outward to receive the bow or ring, which is formed with diagonal slots through which are passed inward projections of the arms, by which the ring is pivotally attached thereto, washers being arranged on the side faces of the ring. The body of the bow or ring extends forward from its tread, and should the rider be thrown, the ring would tilt upon the yoke, so that the foot would be quickly released without catching therein.

Zigang's Telephone.

The principal point in connection with Capt. Zigang's electro-magnetic telephone seems to be his discovery that "when a telephonic membrane is acted upon by an undulating current through the intermediary of an electro-magnet, the currents obtained are, up to a certain limit, more intense and more distinct, as the size of the membrane is limited and its elasticity increased." The apparatus is constructed in conformity with this theory, and is said to possess an advantage over magnetic telephones in that it is less affected by induction currents from neighboring wires.

AN IMPROVED METHOD OF PROPELLING SLEDS.

A novel method of propelling sleds, having for its object healthful exercise as well as providing a rapid method of transportation on ice, forms the subject of a patent issued to Mr. Geo. Gog, Sr., of St. Louis, Mo., and is represented in the accompanying illustration. It con-



AN IMPROVED METHOD OF PROPELLING SLEDS.

sists, first, in the application to the platform of a sled of crossed ropes, chains, or cords, or of a specially shaped stirrup piece for affording a hold and purchase to the feet of the rider; and secondly, in the combination therewith of an adjustable prod or spear, which, on being forced in the ice to the rear of the sled by the rider, propels the sled in the desired direction. See business and personal column.

Copying Drawings by the Aid of a Camera.

BY THOMAS SCOTTON.

Mechanical drawings are sometimes required to be reduced by the aid of photography with the camera. I may say the best results are to be obtained by the wet or collodion process, but very good negatives can be secured with a dry plate, if properly managed. The greatest drawback with the dry plate is the probability of the fine lines on the drawing becoming clogged or veiled over during development.

But I have seen an excellent developer mentioned in the *British Journal of Photography* a few months ago which I have tried with excellent results. It may not, perhaps, be out of place to give it here for the benefit of those who, like myself, have sometimes line subjects to copy:

Carbonate of potassium	360 grs.
Sulphite of sodium	360 "
Water	6 oz.

To each ounce of developer, two drachms of this solution, together with thirty or forty minims of the ordinary ten per cent solution of pyro (and sulphite), are added. The mode of development found to answer best is to soak the plate first of all in gallic acid solution (two grains to the ounce) for half a minute or so, and then transfer it direct to the developer, where, in about another half minute, the image begins to appear. Watch carefully, and when the details in the darkest part of the picture acquire tolerable strength, add five minims of a sixty-grain bromide solution, and proceed until sufficient density is acquired. Should matters hang fire at all, a few drops of the ordinary dilute ammonia solution may be added to freshen up the developer, but this is rarely needed if the exposure has been correct.

On the latter point a word may be said. Though the use of gallic acid does not necessarily lengthen the exposure required, it has been found better to give more than is absolutely necessary. Thus, if five seconds be sufficient to produce a perfect image under ordinary circumstances, give ten or even fifteen. The result will be quicker development and less necessity for forcing, and hence less chance of fog, stain, or filling up the lines. Six times the normal exposure has not produced any signs of the plate being overdone, indeed it seems next to impossible to produce such a result when the gallic acid is employed in the manner described.

The Milwaukee Garbage Consumer.

On invitation of Health Commissioner Martin, a large number of city officials and prominent citizens lately visited the garbage consumer in the southern part of the city, and witnessed the destruction of garbage and refuse by the Merz process, which is believed by some, says the *Sanitary News*, to be the most economical and effective method of disposing of garbage and refuse known at the present time.

About thirty-five tons of garbage—"good, clean garbage," free from ashes—is delivered at the works every day at this time of year. The wagons drive up an incline and unload upon the second floor, where it is immediately thrown into the driers. The driers are tanks about 14 feet long and 5 feet in diameter, having a double cylinder—a small one inside of a larger. Between the shells, or the cylinders, is a steam space of two inches, which has a boiler pressure of eighty-five pounds on constantly. The cylinders have cast iron heads, and a large hollow shaft running through the center of the inner cylinder. This is also filled with steam, and revolves by means of gear wheels, keeping the contents in circulation until thoroughly dried.

The moisture is drawn off by means of a large exhaust fan through a 12 inch pipe and forced into a spray condenser. When the material is thoroughly dried it is discharged from the drier into a conveyor, which deposits it into square tanks called extractors. After being sealed and made air-tight, benzine is introduced into the extractors and the grease is dissolved with a solution of hot benzine. After all the grease has been dissolved and washed out, the material is sold for fertilizer.

The benzine is distilled out of the grease over again and used. The grease is sold to soap and candle makers.

THE queer antics caused by electricity, which is coming into common use everywhere, is a daily occurrence. One of the latest happened recently at Evansville, Ind. During a heavy storm, a number of electric light and other overhead wires were blown down and crossed, and the electric fluid started out to make things lively about the streets. Sparks were hissing and sputtering in all directions; the fire department was called out, and, unaware of the exact state of things, a number of firemen, civilians, and horses were knocked over by electric shocks. Finally a messenger ran to the electric light station, which promptly shut down, when over a dozen persons were found lying about unconscious and were restored with difficulty, two of the firemen at last accounts remaining in a precarious condition. It is such little occurrences as these which make the firemen and the general public alike distrustful of the overhead wires, look they ever so innocent.

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Correspondence.

The Recurved Double-fanged Climbing Rattlesnake.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of July 27, page 57, is an article from C. Few Seiss, Esq., in which he criticises statements made by me in regard to the recurved double-fanged climbing rattlesnake, and which were published in the SCIENTIFIC AMERICAN of July 6.

Mr. Seiss says he has known many instances where rattlesnakes have been found having double fangs, and one instance where there were three fangs on one side and two on the other; but he says, "In all of these instances the anterior fang on each side is the fang proper; the others, or posterior ones, are simply reserve fangs, ready to take the place of the fangs proper when broken and lost, as they frequently are."

In the rattlesnake I have described, the double fangs are not arranged anteriorly and posteriorly in regard to each other, as Mr. Seiss would have it appear, but they are placed in the jaw close together, side by side, in symmetrical pairs, fold down together in the jaw, and can be elevated or depressed together or separately, just as a man elevates or depresses the first two fingers on his hand. The recurved shape of these fangs is so marked and peculiar that even a novice can readily distinguish them from those of the ordinary rattlesnake of this country. F. W. COLEMAN, M.D.

Rodney, Miss., July 30, 1889.

The Rabbit Grub.

To the Editor of the Scientific American:

A few weeks ago I was in the southern part of Illinois, and while hunting shot a full-grown rabbit. I have often heard that old rabbits are not good to eat in the summer, though the same people that would tell me this would say that they would sooner have a young one to eat than a squirrel. I shot several that were half or two-thirds grown, and can quite agree with my country cousins on this point. But as to the old one that I shot, when I picked her up, I found that she had a hump on her neck nearly as big as a walnut, and on further examination saw that it contained a grub or something of that nature, whose black conical head was exposed for about a quarter of an inch. I cut the skin and found the worm-like creature to be about four-fifths inclosed in a sack in the rabbit's skin, which, when the grub was taken out, seemed to be a sack lined with a pinkish membrane resembling a mucous surface, and in a perfectly healthful condition, there being no apparent pus exuded or any inflammation. The grub was about one and a quarter inches long, and about five-eighths of an inch in diameter in its middle. It was black and had a few bristly hairs between its joints, for it was an articulated creature with no legs or feet—like a caterpillar chrysalis.

Can you tell me through the columns of your paper something about this repulsive, disgusting thief who steals his house and warmth from the poor rabbit and makes our country cousins to say, "Rabbits is pizen in the summer cauz they's got worms"?

HIRAM M. HOWARD.

Cincinnati, O., August, 1889.

[In answer to the above, Prof. Howard, of the Division of Entomology, states that the grub found under the skin of the neck of a rabbit is one of the rabbit bots, and probably the species described nearly a hundred years ago by Bracy Clark in his well known essay on bots as *Cuterebra cuniculi*. The specimens from which he described the species were from Georgia. *C. horripilum* is probably the same insect and has similar habits. It is found from Georgia to Nova Scotia.—EDS.]

Honors to an American Entomologist.

The announcement that the French government has conferred upon Professor C. V. Riley, entomologist to the United States Department of Agriculture, the distinction of Knight of the Legion of Honor is one of considerable interest to English agriculturists. In the first place, Dr. Riley is an Englishman by birth, having been born in London in 1843, while the early years of his boyhood were spent at Walton-on-Thames; and secondly, wherever economic entomology has made any progress—in whatever district the art of circumventing the ravages of destructive insects has made any headway—Dr. Riley's name is as a household word. It has previously been stated in these reports that Dr. Riley is expert commissioner for Group VII. and representative of the Secretary of Agriculture in Paris in connection with the exhibition, the beautiful and typical American agricultural display having been got together under his direction. It is not, however, in this official capacity that Dr. Riley has been decorated by the government of France, but solely in acknowledgment of his scientific work. M. Leopold Faye, the Minister of Agriculture, has emphasized this circumstance, for, in writing to Dr. Riley last week, he said, "In conferring on you this high distinction the government of the republic has sought to reward the important services which you have rendered to agriculture generally of all countries, and particularly to France, by your labors and your discoveries." M. Tisserand, the accomplished Directeur de l'Agriculture, in his usual felicitous phraseology, informed Dr. Riley that "France was but paying an old debt of gratitude." Those discoveries of Dr. Riley which have been of most—indeed, almost unanticipated—value to France were, first, in 1870–73, those connected with *phylloxera*—the discovery of its indigenous American character, and of the identity of the French and American insect, and the study of resistant American vines and their recommendation as stocks in France; secondly, the invention, in 1882–84, of the Riley nozzle, which forms the essential part of all the spraying apparatus against the mildew. Since this Dr. Riley's most important work has probably been the introduction of the parasites and natural enemies of the insect pest, *Icerya Purchasi*, from Australia to California. On the plan of setting a thief to catch a thief, or on the principle that a reformed poacher makes a good gamekeeper, this campaign against insect pests, by means of their natural enemies, is one of the happiest of Dr. Riley's efforts. The beautifully illustrated entomological reports which are officially published at Washington are known throughout the world, and these are the outcome of the precise knowledge and artistic skill of the accomplished entomologist whom the French government has so gracefully honored. Dr. Riley was in England in the summer of 1887, when he unraveled the mystery of the hop plant louse or "fly," which causes so much havoc in the hop yards of Kent. He recently came over from Paris to spend a couple of days at the Windsor show, on which occasion he wore the extremely rare badge of an honorary member of the Royal Agricultural Society of England.—*London Morning Post.*

Perhaps we ought to add to the distinctions. It is hardly necessary to remind our readers that among the additional distinctions enjoyed by Dr. Riley is that of contributor and correspondent to the SCIENTIFIC AMERICAN.

Amateur Photography, Ancient and Modern.

By ancient amateur photography we mean the practice of the art say fifteen or twenty years ago, with the wet collodion process, and prior to the present general use of dry plates.

Modern amateur photography is a very different thing. It consists, substantially, in pointing a camera and touching a spring. It requires no study, no knowledge, no experience, no genius, no skill. Even children are now photographers, and the camera is coming to be a toy. How different were the duties of the ancient amateur photographer was ably described by Mr. Henry J. Newton in a recent address before the New York Society of Amateur Photographers. He said:

To succeed then meant hard work and study. You were required to know how to make almost everything connected with the production of a photographic print. You must know how to make collodion; how to coat a plate, and how to sensitize and develop it; how to construct the silver bath in which the plate was sensitized; how to make the developer; how to clean the plate; how to prepare the nitrate of silver bath for sensitizing the albumen paper; to fume, print, tone, and fix the prints; how to make paste, and how to mount the prints. The amateur of those times was further required to make himself familiar with the chemistry involved in all this work; first, in order that what he did he might do intelligently and successfully, and second, to be qualified to determine with a degree of certainty what was the matter when his chemicals gave unsatisfactory results.

The negative bath was one of his most treacherous friends; he could not predict, with any degree of certainty, what would happen to the next plate by the result on the one immediately preceding it. There seemed to be a demon lurking in the dark room watching for an opportunity to get you into trouble, and as the negative bath was the most sensitive, he would take advantage of this weak point; and if he had got into it bodily, with all the sulphur and cinders he is supposed to have adhering to his external person, and stirred it up vigorously with his fabulous pitchfork covered with lava from the pit, it could not have made the bath worse than it would sometimes get in an incredibly short time; and this would always happen at the worst possible moment. If you had invited some *particular friend* to have his picture made—some one to whom you wanted to show what you could do and what beautiful negatives you could make, how expert you had become—then this demon delighted to get into the bath and muddle it, so that, do the best you could, nothing but fog, fog, would be the result. The amateurs of those times wished frequently that Job had lived in their times and had become an amateur photographer; they did not believe he would think a few boils of any account, or if he did he would not have taken the first premium in a competition for patience.

It was such vexatious trials which kept the ranks of amateurs thin, and when one happened to be exposed and took the fever, he would not ever it in a year or two, and so complete would be the cure that you would never suspect that anything had been the matter. There were a few exceptions to this rule, which was when the trouble became chronic. I could point to a few examples of persons so affected; your speaker was one of that class. To him there is a fascination and a satisfaction in experimenting.

The development of an exposed plate brings one into close and intimate relation with nature. You are admitted into one of her interior sanctuaries, while she places in your hand one of her magical wands, and while you look at the white plate before you, lo! a form begins to come forth like a specter from its winding sheet, and apparently it throws off fold after fold of its snowy environments until it stands revealed in perfection and beauty. What can there be more wonderful than this?

A Georgia Possum Orchard.

A few miles west of Griffin is the home of William Throckmorton. Mr. Throckmorton is the proprietor of the most unique and remunerative farm in Georgia. It is the "Lime Creek Possum Farm."

On the very crest of a well-wooded hill is a comfortable cottage surrounded by beautiful shade trees. At the foot of the hill is a pretty branch running through the very center of a ten acre persimmon grove inclosed within a high board fence. The persimmon trees are interspersed with a quantity of old hollow trees and hollow logs planted in the ground.

It was in the early afternoon when we arrived, and to the uninitiated the farm appeared to be an immense fruit orchard bearing an oblong whitish sort of fruit hanging from the dead limbs of the trees by a long, black stem. But appearances were deceptive. It was not fruit, but between seven and eight hundred possums taking their afternoon siesta.

The possum, when desiring to take a nap, simply climbs the most convenient tree, walks out on a limb, wraps his tail one and a half times around, and swings his body out into space. His legs and feet are drawn close in to his body and his head drawn up between his shoulders until it forms an almost perfect ball, and appears to be a great pear covered with white fur.

The sun was slowly setting below the distant pine mountains and we were still gazing at the queer objects in amused wonder when a half dozen little possums emerged from the pocket of their mother, ran up her tail and commenced playing on the limb above. In a few minutes this marsupial stretched her head and then her fore-feet out. She swung herself once or twice, grabbed her tail with her forepaws and climbed up it to the limb, which she caught with her claws, untwisted her tail and pulled it up. Hardly had she balanced herself when the half dozen young ones climbed into her pocket and were hid from view. She then climbed down the tree.

While this was going on, more than 700 others had awakened and were coming down from the trees. Reaching the ground, each one made for the creek, drank, and then ran up the hill to a pen in which they were to be fed.

They were of all sizes. Some would barely weigh a half pound, while others would tip the scales at thirty. The possum, when hungry, utters a sound which is a cross between a mew and a moan. Over 700 possums were together so thick that the ground could not be seen between them, and the small ones had been forced upon the backs of the larger. All were uttering this peculiar sound.—*Atlanta Constitution.*

Phosphorus.

An improved method of producing phosphorus consists in treating bones or powdered mineral with nitric acid. A large proportion of the calcium is then removed from the solution—on the addition of potassium sulphate to liquid—in the form of calcium sulphate. The liquid then contains phosphoric acid and potassium and calcium nitrates. After removing the precipitated calcium sulphate by means of filtration, sufficient mercurous nitrate is added to precipitate the phosphoric acid as mercury phosphate. The phosphate of mercury so obtained is collected and dried, and afterward distilled with carbon, when mercury and then phosphorus are distilled over. The mercury may be reconverted into nitrate to serve as a second charge, and the liquors, after removing the mercury phosphate, yield, on adding more potassium sulphate, a solution from which potassium nitrate can be crystallized.

Weight and Power of Boilers.

The indicated horse power developed from various English boilers per ton weight of boiler is stated to be as follows:

Peninsular and Oriental steamers	16·6
H. M. S. Anson	21·3
Locomotive boiler of torpedo catcher	43·0
Locomotive boiler of torpedo boat	48·0
Thornycroft's water tube boiler	55·0

The useless dead weight in boilers and machinery carried by many steamers is something enormous. The ingenuity of engineers is greatly needed in this direction.

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THE MacCOY PNEUMATIC TOOL.

We illustrate in the present issue a machine which is of peculiar interest from a strictly mechanical as well as from the general point of view. It is the invention of Messrs. James S. MacCoy and George Williams, of the city of New York, and of Mr. Frank H. Marsh, of Newark, N. J. Within its own field, which is a varied one, it seems destined to effect an important modification in industry. It involves the application of the principle of light hammer blows, repeated with high velocity, to the execution of mechanical work in wood, metals, stone, and other materials. In a certain sense it recalls the sand blast, where the percussion of an almost infinite number of projectiles is caused to wear away and engrave a smooth surface. In the MacCoy implement, a single cutting tool is used, but is subjected to an immense number of blows repeated with the highest velocity and at a rate as yet undetermined. The instrument is remarkable as well for its simplicity and power as for its wide range of work, and by its action attains a mode of operation peculiar to itself. It is called a pneumatic tool, as it is generally designed to be held in the workman's hand and to be driven by compressed air. Carried by a suitable support, it can be driven equally well by steam. We shall first describe the tool as briefly as possible.

It consists of a cylindrical case bored out internally so as to receive a piston. The actuating portion of the piston is uppermost as the sectional illustrations stand, and is prolonged downward of reduced diameter, as if forming a piston rod, which again expands so as to form a second piston-like collar or hammer head. The actuating portion, as we have termed it, which is really the piston proper, is contained in its own chamber, within which it can reciprocate like the piston of a steam engine. At the end of each stroke it is air-cushioned. From the lower part of the tool a stem projects adapted to carry any desired chisel. This stem is free to move up and down. In the lighter class of tools it is normally pressed upward by a spiral spring. When the piston is driven downward, it strikes the head of this loose stem. At the upper end of the case is a nozzle to which a hose connected to an air or steam supply can be connected. The piston is drilled transversely, and in this aperture a valve travels back and forth. It is turned out of a single piece of steel, and cylindrical, with three collars. Four passages for air go through the piston. As the valve travels back and forth, it opens and shuts the valve openings, so as to admit compressed air to one end or the other of the piston, and to bring each end of the air chamber or cylinder alternately in communication with the atmosphere. The compressed air itself causes the valve to travel back and forth. The effect is simple. When air at high pressure is admitted, it actuates the valve, and in consequence the piston, which at once starts into action with lightning-like rapidity. It beats back and forth, air-cushioned at the end of each stroke, on each downward movement striking the upper end of the stem. As many blows per minute as 15,000 are spoken of by the inventors. Whether this rate has been attained is doubtful, but with its air-driven valve and exceedingly limited number of parts, it has the capacity for velocity, and certainly attains a wonderfully high rate of action.

The tool is provided with its own throttle or cut-off valve for stopping or starting it. This, as now adopted, acts by closing the air outlet. It has no projecting parts, and is casehardened throughout, so that it is not susceptible of injury. It will stand the most severe usage and even abuse.

To the stem the cutting tool or chisel is attached, the lever end of the stem entering into a hole drilled and reamed in the end of the chisel. From the description it will be seen that the construction is simple to the last degree, a piston, valve, and loose stem being the moving parts. In some of the larger sizes the spring for pressing back the stem is not used. The stem drops forward out of reach of the striking end of the piston head. In this class the chisel receives no blows until pressed upward within reach of the piston head by contact with the work.

To drive it, air at a pressure of about 40 pounds to the inch is used. A number of sizes are constructed for a large range of work. As a cutting instrument, it may be used on every material—wood, stone, or metal. As a tamping machine, it can be employed for everything, from filling teeth to calking steam boilers. It has also received an extensive application for repousse silver and sheet metal work and engraving.

To acquire an idea of its power, the action of the large size upon a block of brown sandstone may be cited. A heavy chisel, two or three inches wide, is inserted in place, the air is turned on, and at once the tool begins to hum like a top, and vibrates, or rather trembles, in the hand. The cutting tool is now pressed against the stone by the operator. The multiplicity of light blows begin to show their force. The stone at the point of the chisel is converted at once into dust, the edge enters the stone, and begins to wedge off chips half as large as the hand. Almost as fast as the tool could be conveniently moved forward, even without obstruction, it plows its way through the material, absolutely planing the solid stone as a carpenter would treat a block of soft wood, but deeper and more rapidly. A more remarkable exhibition of power cannot well be thought of. A tool weighing, perhaps, fifteen or twenty pounds, held without any bracing by the workman, cuts stone as if it were cheese.

To show its delicacy a smaller one may be used. A tool not much larger than a pen holder, designed for filling cavities in teeth, is fitted with a chisel. With this marble can be carved with the greatest delicacy, the shaping reminding one of modeling in clay. The marble yields to the rapid percussion as if it were a plastic material.

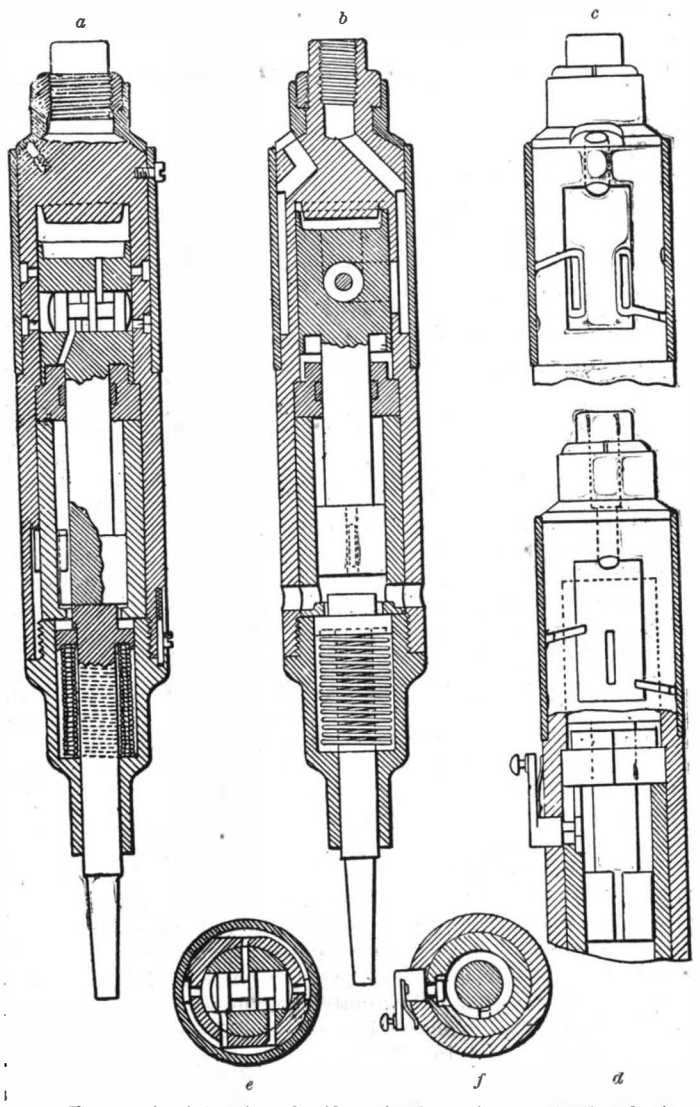
Its action on iron comes next. A cut can be carried right across a smooth face, with slight pressure from the person holding it, a smooth chip or shaving curling away sidewise from the cut, such as might have been turned out by a sharp chisel driven by a skilled workman. In wood the action is the same. With a gouge as cutter, chip after chip is cut away, the wood yielding with curious and almost plastic facility. The cut can be carried up to the very edge of the block without danger of splitting. When the gouge is forced in too deeply, the work is checked, but by keeping one or the other corner free, the chips come away as fast as the tool can be moved around so as to cut them away from the body of the wood.

The above describes the experiences of the writer. It is safe to say in each minute the instrument strikes more blows than a good workman would in a day of ten hours. Owing to the small range of action of the piston, the blows are individually of slight force, the remarkable power being derived from their multiplicity. These trials disclosed the more characteristic action of the tool where cutting is involved. It is also used to actuate a striking tool for doing repousse work in metal. The metal yields to the blows, swelling up into shapes that by the skillful operator can be given any shape, such as birds, fruits, or other objects. Separate strikers are provided for different inside and outside work, and the striking bits can be changed at will according to the class or stage of the design.

Owing to the extreme rapidity of the succession of blows, no recoil, or a very slight and easily controlled one only, is felt. To this peculiarity, much of the efficiency of the instrument is due. It can, without trouble, be held to its work, and the finest lines of a design can be followed with precision. Marble can be cut away to a pencil mark; across a smooth surface of iron a cut can be carried with the utmost accuracy. On some materials it accomplishes a new result in its planing action. Thus, stone can be worked off to a surface just as a carpenter would plane wood. All these are possible on account of the absence of recoil.

We illustrate several of its applications. In the mine it can be used to cut away the mineral. This use illustrates the lowest stage of stone cutting. In the marble factory and sculptor's atelier it is used for the most delicate carvings. Work of the most artistic type can be executed by it with a rare combination of freedom and precision. The iron worker uses it for chipping and calking. We illustrate its use on steam boilers. Finally, its use by the jeweler on repousse work is shown. The worker in precious metals, and in art work generally, can employ it with great effect, also, as an engraving tool, and can produce beautiful effects by combining engraving with repousse designs, all performed by it.

The tool can be seen in operation at the works of the American Pneumatic Tool Co., 431 Eleventh Avenue, New York City.



a. Front sectional elevation. *b*. Side sectional elevation. *c*. Showing eduction chamber. *d*. Induction chamber and side-stop motion. *e*. Valve chamber plan. *f*. Throttle plan.

SECTIONS OF THE MacCOY PNEUMATIC TOOL.

The Lesson of Spokane.

Providence seems determined to teach the growing young giants of the West lessons not to be forgotten. And first among these lessons, which are applicable not only to Seattle and Spokane, but to every young town or city on this continent, are the absolute necessity of an ample water supply under pressure and the employment of fireproof or as nearly fireproof materials as may be in construction.

At Spokane the story is, in many respects, an exact repetition of the destruction at Seattle, wooden structures, dry as tinder, insufficient water supply and pressure, with the result that the substantial and well built portion of the city was swallowed up in a conflagration that could not be checked.

The object of our remarks is not to point out so much what has happened, as to suggest that it is within the reach of every community to prevent a repetition of like disasters. In the first place, the supply of water under pressure is not the expensive matter that it formerly was. The improvement in manufacture now gives us at a moderate price a sheet steel pipe of sufficient size to serve as a water main, and only 16 or 18 B. W. gauge, and yet with a bursting strength of 700 pounds to the square inch and a working pressure of one-third that figure. This pressure is one that would always be of great assistance in case of fire, and in many instances would have enabled an otherwise destructive fire to be checked in the outset. Then, again, the question of keeping up this pressure, if not supplied by natural gravitation, is being simplified and cheapened every day. Pumps are more reliable and economical in their duty year by year, and no young community need be deterred from undertaking a thorough water works system on the score of expense or difficulty of obtaining the necessary technical information. A slight investigation into the matter will convince any one that the investment would be a good one and a very efficient form of insurance.

A still better form of insurance is prevention of fires, and in referring to this part of the subject we are only repeating what we wrote in our issue of July 6th—remarks which are emphasized by the Spokane fire. Wood is, and always will be, used as long as it is cheaper and more convenient than other materials as the prime factor in construction of a new town.

The danger attending its presence must therefore in some way be avoided, and this can best be done by the use of fireproof paints. Their cost would be a small price to pay for the immunity afforded, as a cheaper form of insurance cannot be found, and it is a matter of astonishment to us that the general adoption of these protections should be so slow in the West, where wood is so largely used and the danger so evident.—*Engineering and Mining Journal.*

A Tower on Eagle Rock, West Orange.

Eagle Rock, at West Orange, N. J., is 640 feet above tidewater. It is proposed to build upon it an iron tower 400 feet high, with elevators to take passengers to the top, and to construct to the rock, from Washington Street, Orange, a cable railway for passengers. In addition to this the plateau will be improved and a hotel and wagon sheds will be erected. The view from Eagle Rock embraces the ocean, New York bay, and Coney Island, besides the broad and beautiful valley in which the city of Newark and the counties of Essex and Union lie, and an extended view of the Hackensack valley.

A New Gun.

The Board of Ordnance and Fortification, under the authority of an act of Congress, have approved the construction of one 8 inch Haskell multicharge dynamite gun, to cost $28,000, payable on delivery at Sandy Hook, N. J., where the gun is to be tested. We understand the new gun will be constructed soon. Novel results are expected.

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A POWERFUL BATTERY.*

The plunging battery shown in Fig. 1 is a very powerful one, designed for running an electric motor or for supplying a current to three or four small incandescent lamps. The battery consists of eight elements, each formed of two 6×10 inch carbon plates ¼ inch thick, and one zinc plate of the same size, suspended in a cell 3½×7½ inches and 9 inches deep.

The upper ends of the carbon plates are paraffined, as shown in Fig. 2, by heating the ends only and rubbing on paraffine, allowing it to melt and soak into the pores of the plate until a strip about 1½ inches wide across the end of the plate is well filled with paraffine. This treatment prevents the solution from ascending by capillarity and destroying the connections.

The plates are arranged as shown in Fig. 2, the zinc plate being located between two carbon plates and separated from them by strips of paraffined wood ¼ inch thick, 1¼ inches wide, and 8 inches long. The plates and separating strips are clamped together by thick strips of paraffined wood arranged upon the outer side of the carbon plates, and bolts, preferably of brass, passing through the ends of all of the strips. The electrical connection with the zinc plate is made by inserting a copper strip, *b*, between the plate and the wood strip. The connection with the carbon plates is made in a similar way, the strip, *b*, being looped so as to form a contact with both plates without touching the zinc.

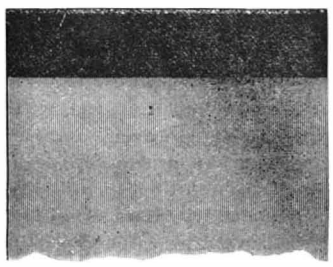

Fig. 2.—PARAFFINED PLATE.

Before the elements are put together, the zinc plates should be carefully amalgamated. This is done by dipping each plate into a jar of dilute sulphuric acid (acid 1 part, water 10 parts), containing mercury at the bottom. As soon as the lower end of the plate is coated with mercury it may be lifted from the solution, inverted, and allowed to stand until the entire surface of the plate is perfectly covered with mercury. If there are portions which do not receive the mercury, they are scraped or sand-papered and returned to the acid solution, when mercury is applied locally.

If the amalgamation is perfect, the plates will not require re-amalgamation. An amalgamating solution is made by dissolving mercury in nitric acid, then adding water so as to make a 10 per cent solution of the mercury nitrate. A zinc plate immersed in the solution becomes amalgamated, but the operation requires frequent repetition.

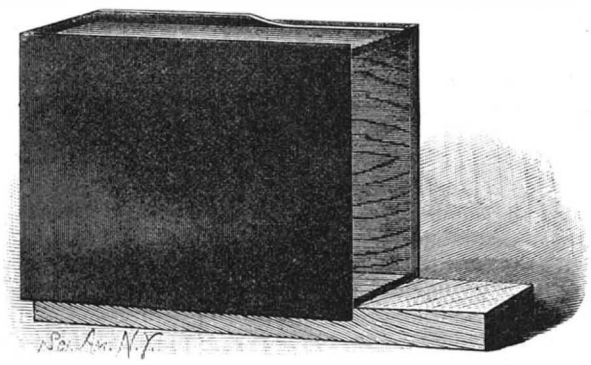

Fig. 4.—FORMING THE GUTTA PERCHA LINING.

The cells consist of pine boxes of the size mentioned lined with gutta percha. The operation of lining is quite simple, and the cell, if well made, is durable. A wooden form is made which is the thickness of the gutta percha smaller than the boxes. Around the sides and end of this form is wrapped a sheet of gutta percha, which is ¾ inch wider than the form, the edges of the sheet being allowed to project beyond the form, as shown in Fig. 4.

A piece of gutta percha of suitable width and length is placed upon the form within the projecting edges of the sheet already in position. The edges are then warmed sufficiently to render them adhesive, by means of a lamp flame or by holding a hot iron near enough to soften the gutta percha. The edge is then turned over in the manner illustrated. The fingers should be moistened to prevent the gutta percha from adhering to them. When the lining is complete, it is placed in the wooden box and expanded to fit by filling it with warm water. The upper edges of the lining should be turned over upon the edge of the box and made to adhere by heating. The box should be thoroughly coated with shellac varnish inside and outside, and allowed to dry before introducing the lining.

Glass jars suitable for this battery may be purchased from dealers in electrical supplies. They are quite expensive and liable to be broken. Porous shells of various sizes and shapes are also obtainable. These, when saturated with hot paraffine, make excellent battery jars, which cost less than glass.

Eight of these cells are placed in a box having removable sides and a frame extending over the top. To the vertical standard of the frame is loosely fitted a horizontal frame which supports the plates of the battery. In the upper part of the frame is journaled a shaft provided at opposite ends with drums, to which are attached chains for lifting the horizontal frame and plates supported thereby. The shaft is provided with a crank by which it may be turned, and with a ratchet which is engaged by a spring pawl attached to one of the stardards.

The copper strips connected with the zinc plates are clamped to the strips extending from the carbon plates, and the terminal strips are provided with binding posts for receiving conductors. Each set of plates is provided with a hook, attached to the clamping strips by means of a crossbar of vulcanite or vulcanized fiber. These hooks are designed to be placed on the shaft when it is desired to use only a part of the cells, the unused plates being detached from the others and suspended out of contact with the solution. On account of the difficulty of removing the hard and almost insoluble crystals of chrome alum formed in batteries employing a solution of bichromate of potash, a bichromate of soda solution is substituted. The crystals forming in the bichromate of soda solution are readily removed from the cell.

This solution is made by dissolving bichromate of soda in warm water to saturation, allowing it to cool, then slowly adding commercial sulphuric acid to the amount of one-fifth of the volume of the bichromate solution. As the gutta percha lining of the cells melts at a low temperature, the solution should be allowed to cool before pouring it into the cells.

The plates should not be plunged into the solution to a greater depth than is necessary for the production of the desired current, and they should always be withdrawn after use. The electro-motive force of this battery is 16 volts, and the maximum current is 4 amperes. This battery is designed for running the simple electric motor described in SUPPLEMENT, No. 641.

When the winding of the motor is of coarse wire, the battery may be connected two cells in parallel and four in series. The resistance of the motor may be reduced by connecting the field magnet terminals directly with the commutator brushes, thereby making it a shunt machine. In this case it will be advantageous to connect the cells, four in parallel circuit, and two in series. If the resistance of the motor is so low as to permit of connecting all the cells in parallel, without unduly heating the coils of the motor, this arrangement will yield the best results. When the motor is connected as a shunt machine, too much of the current will go through the winding of the field magnet, unless some additional resistance is included in the field magnet circuit. A coil of No. 24 iron or German silver wire will answer for this resistance. The required length can be readily determined by experiment.

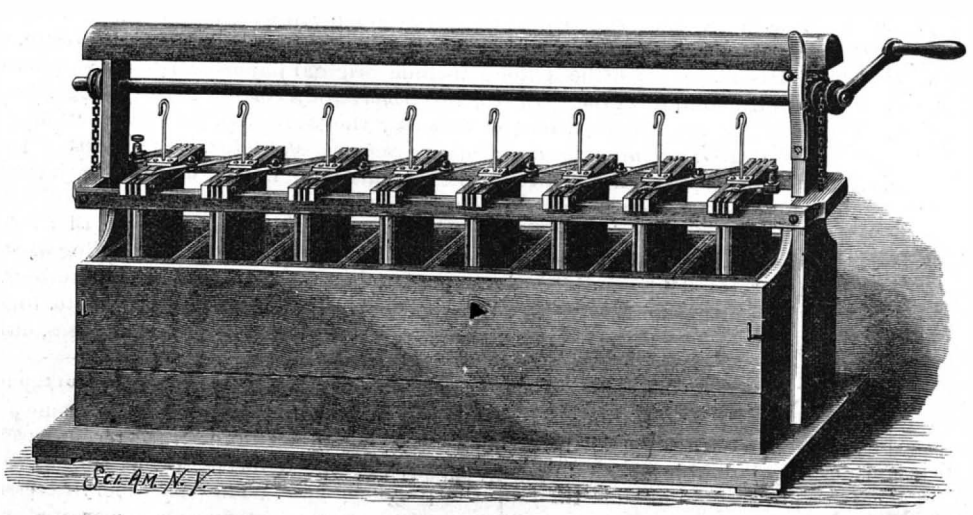

Fig. 1—LARGE PLUNGE BATTERY.

THE oldest steamer in the world, according to the *Steamship*, is lying in Bowling Harbor, on the Clyde. The Industry, built in 1814, plied for about sixty years on the Clyde, and was finally laid up where she now lies. Last year the engine, a side-lever one, with spur wheel gearing, was taken out and placed in the Kelvinside Park at Glasgow. The old boat is fast breaking up, and will doubtless shortly disappear. The engine, however, will show to future engineers what a side-lever engine was like, and how it was connected by gearing to the paddle shaft.

* From "Experimental Science," by Geo. M. Hopkins. In press. Munn & Co., publishers, New York.

An American Abroad.

While emperors and queens are receiving the highest honors and the most lavish entertainment within the province of royalty, an American has commanded a characteristic welcome in Europe. This is Edison, whose genius commands the homage of Paris, London, and Berlin. One of the most modest and least pretentious of men—not even Franklin had more marked simplicity of manner—he has been received in the preoccupied and distracted French capital as one of the wonder workers of the modern world. Kings and princes have visited the exhibition during this summer of fetes and surprises, but not one of the distinguished personages of the Old World has received a higher tribute of appreciation or a more enthusiastic welcome than this master mechanic. Even royalty has joined in this democratic greeting to an untitled and unostentatious man of genius. The English Queen has honored him by sending a message of congratulation breathed from her own lips into one of his phonographs.

America could have in Europe no worthier representative of the consummate flower of its national life and progress than this modest scientific investigator and industrious mechanic. Its chief contributions to the world's stock of civilization have been the works of its inventors. In that beneficent field of human effort its sons are unrivaled for practical skill, habits of scientific investigation, and triumphs of mind over material forces. While the European continent to-day is a circle of camps swayed by the caprices of sovereigns whose inherited functions are their only title to fame, America has expended its energies in working out an industrial development that is the marvel of Christendom, and the real leaders of its pacific progress have been and are its inventive mechanics—men of the Edison stamp.—*N. Y. Tribune.*

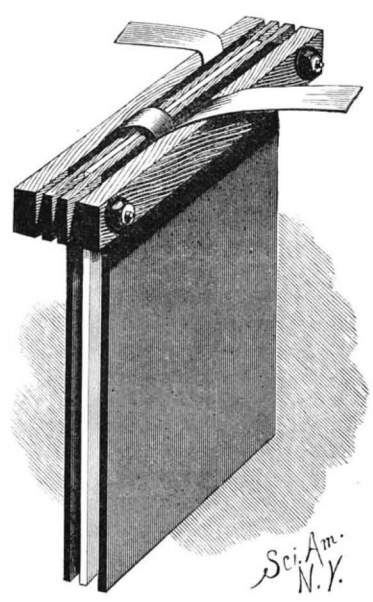

Fig. 3.—ARRANGEMENT OF BATTERY PLATES.

A Countermining Torpedo Ship.

Captain Zalinski, U. S. army, states that a ship specially designed for countermining and carrying the pneumatic torpedo gun is now under discussion. It is to be of 3,300 tons displacement, on a draught of 18 ft.; it is to be turtle backed, protected by 5 in. of steel armor, and is to have its under-water hull especially strong, being well protected from the action of torpedoes by numerous compartments and cellular subdivisions, these latter being filled with cellulose, if found desirable. She is to carry an ample supply of coal and ammunition. The shells to be used will be of 8 in. sub-caliber, fired from 15 in. guns, of 100 lb. bursting charge. It is supposed that 1,200 of these will suffice for countermining a channel 7 miles long and 100 yards in width. Three guns are to be mounted forward and abreast of each other, as in the Vesuvius, the middle gun to be fixed in direction but capable of elevation, while the two outer ones will have a slight lateral train. Sets of shell will then be thrown so as to clear the channel, 100 ft. at a time. It is thought that the upward lift of the great wave formed by the simultaneous explosion of three shells will not only explode the fixed mines and break up connecting cables, but also tear the buoyant mines and circuit-closing buoys away from their moorings.

Saccharine.

This substance, which, as known, is three hundred times sweeter than sugar, is beginning to be felt by the beet sugar manufacturers as a very dangerous enemy. It is stated that in Germany, already, so much saccharine has been made as to render 5,000 tons of beet sugar superfluous. It is principally employed in the preparation of fruits and the production of sweet liquors. It is not a food stuff. Indeed, it has been condemned by eminent medical authorities as directly prejudicial to health. The sugar manufacturers are of the opinion that saccharine should only be sold by chemists. France, Italy, and Portugal are already contemplating imposing a tax upon it.

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THOMAS CORWIN MENDENHALL.

BY MARCUS BENJAMIN.

We have followed from year to year the meetings of the American Association for the Advancement of Science, as they have been held in various parts of the Union. In 1886 New York City was its meeting place, last year it was Cleveland, and this year the Association is gathered in Toronto.

On this occasion the president is a distinguished officer of the national government. In succession, the secretary of the Smithsonian Institution, Professor S. P. Langley, and the director of the United States Geological Survey, Major J. W. Powell, have held the presidency, and this year it falls to the superintendent of the United States Coast and Geodetic Survey.

President Mendenhall was born on October 4, 1841, near Hanoverton, in Columbiana County, Ohio. He is the son of Stephen and Mary Mendenhall, and is descended on his father's side from Benjamin Mendenhall, who, with his brother John, both Quakers, emigrated from near the manor of Mildenhall, Wiltshire, England, with William Penn, and settled in Delaware County, Pennsylvania.

The only schooling that young Mendenhall ever received was that obtained in a small country village, under conditions which, at best, were far from favorable. But an early fondness for the study of mathematics and natural sciences led him to follow these branches by himself, and his present reputation as an authority on such matters is entirely the result of his own efforts.

In 1873, on the organization of the Ohio State University, he was elected to the chair of physics and mechanics, which he then held until 1878, when he accepted the professorship of physics in the Imperial University of Japan at Tokio. While in Japan, in addition to organizing a special course in physics and establishing a physical laboratory in connection with the science department of the university, he accomplished much scientific work. He founded a meteorological observatory, in which systematic observations were maintained during his stay and afterward until it was merged into the general meteorological system which was established by the Japanese government. Detailed reports of the work were published both in the English and Japanese languages. Professor Mendenhall also carried out an investigation on the force of gravity at the sea level and on the famous Japanese extinct volcano Fujiyama, on the summit of which he was encamped with a party for several days while engaged in that work. He made careful measurements of the figure of the mountain and of its density, from which data he deduced a value for the mass of the earth that agrees very closely with that which Francis Baily obtained by the Cavendish method. About this time he also made a series of elaborate measurements of the wave lengths of the principal Fraunhofer lines of the solar spectrum by means of a large spectrometer which at the time of its construction was one of the most perfect in existence. As this investigation was made before Professor Henry A. Rowland had produced his famous diffraction gratings, some fine specimens of Lewis M. Rutherfurd's rulings were employed. No very exact measurements of the gratings space was made; hence the results were only valuable as relative measures, but as such they rank among the best published up to the recent introduction of more accurately known rulings. Professor Mendenhall became interested in earthquake phenomena while in Japan, and was one of the founders of the Seismological Society of Tokio. With Professor E. S. Morse and others he gave public lectures on scientific subjects to general audiences in the temples and theaters of the city of Tokio, out of which grew the establishment of the first public lecture hall in the Japanese empire.

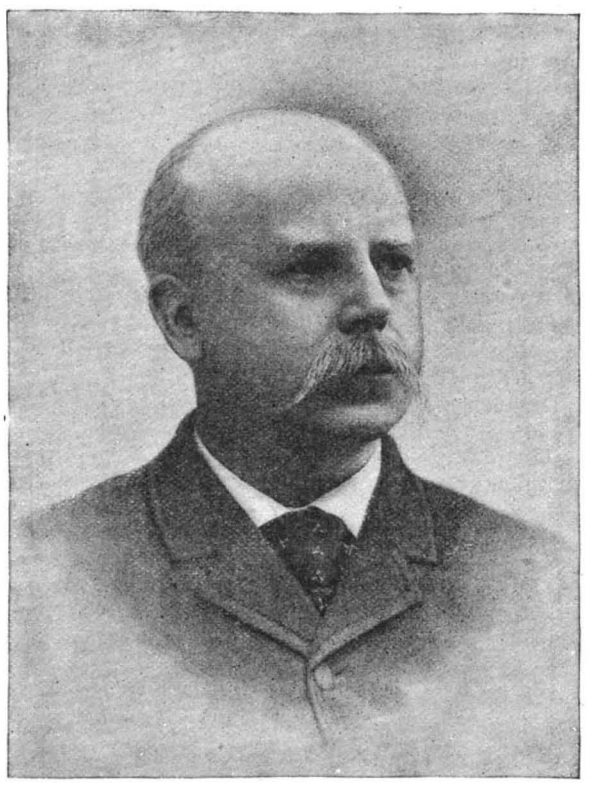
In 1881 he returned to the United States and resumed his chair at the Ohio State University. In the following year he organized the Ohio State Weather Service, of which he was director until 1884. He was the first to devise and put into operation a system of weather signals for display upon railway trains. The system of signals used became general throughout the United States and Canada, and continued in service until the introduction of a new code by the chief signal officer in 1887.

Prof. Mendenhall was appointed, in 1884, professor in the United States Signal Service at Washington, where he organized and equipped a physical laboratory in connection with the office of the chief signal officer, and inaugurated systematic observations of atmospheric electricity. In connection with this work he investigated the methods for determining ground temperatures, for which purpose he has invented several forms of apparatus, and he was the first to establish stations in the United States for the regular collection of earthquake phenomena. He was sent to Charleston immediately after the earthquake of August 31, 1886, and made a report upon the agitation, with a coseismic chart showing the disturbed area.

In 1886 he resigned from the service of the government to accept the presidency of the Rose Polytechnic Institute, in Terre Haute, Ind. This place he held with great credit to himself, guiding, with able hand, the fortunes of this young institution through the struggles of its early existence into an assured place among the technical schools of the country. At the recent commencement exercises he was able to say that every member of the graduating class had already secured an engagement of some sort, thus being able to at once begin his life work. No greater evidence of the thoroughness of the training at that institution could be forthcoming.

Early in July of this year Professor Mendenhall was nominated by the President to fill the place of superintendent of the United States Coast and Geodetic Survey. This office, one of the most distinguished scientific appointments in the country, has been held by men of great eminence. That so worthy a successor has been found to Alexander Dallas Bache, Benjamin Peirce, Julius E. Hilgard, and others, whose reputations as scientists are so celebrated, is indeed a matter of congratulation.

Professor Mendenhall has lectured extensively to popular audiences on subjects mostly relating to physics. He has given courses and single lectures at the Lowell Institute in Boston, the Peabody Institute in Baltimore, the Cooper Institute in New York City, the Mechanics' Institute in Cincinnati, and elsewhere. The honorary degree of Ph.D. was conferred on him by the Ohio State University in 1878 and that of LL.D. by the University of Michigan in 1887.



PROF. T. C. MENDENHALL, PRESIDENT AMERICAN ASSOCIATION FOR ADVANCEMENT OF SCIENCE.

Besides membership in many scientific societies, he was in 1887 elected to the National Academy of Sciences before which body he has read the following papers: "On the Influence of Time on the Change in the Resistance of the Carbon Disk of Edison's Tasimeter;" "Seismoscopes and Seismological Investigations;" "On an Improved Form of Quadrant Electrometer, with Remarks upon its Use;" and "Recent Researches in Atmospheric Electricity."

He was elected a member of the American Association for the Advancement of Science at the Indianapolis meeting in 1871, and was advanced to the grade of fellow in 1874. In 1882 he presided over the section on physics, and at that time delivered the usual address. He has been a frequent attendant at the meetings since that time, and last year was chosen president, in which capacity he will act at the Toronto meeting.

His many scientific articles include original papers published in the *Proceedings of the American Association for the Advancement of Science;* the *American Journal of Science*, *Nature*, *Popular Science Monthly*, and other periodicals, also he is the author of monographs that were issued by the University of Tokio and several special reports on seismology issued by the United States government. In addition to the foregoing, he has published a popular treatise entitled "A Century of Electricity" (Boston, 1887).

Fair of the American Institute.

The opening of the American Institute fair, on October 2, is an item of interest to the inventors and manufacturers, and the record of last year shows more than double the number of visitors, at the reduced price of admission, than of the previous year. The forthcoming exhibition will be the 58th in the history of the Institute, and as the arrangements for space and selling privileges are now being made, early application to Mr. Charles Wager Hull, the general superintendent, at the office of the Institute, Astor Place, New York City, is a word of timely advice to those who wish a showing.

Camphor Compounds.

The compounds formed by camphor with chloral, phenol, betol, salol, resorcin and other substances have attracted some attention in recent years in consequence of the introduction of some of them into medicine. Most of them present the peculiarity of being liquid products of the combination of two solids, and even when this is not the case, as in the compounds of camphor with hydroquinone, salicylic acid, tannin, and gallic acid, the temperature of the melting point of the joint product is much below that of either of its constituents (*Repertoire,* July 10, p. 289). M. Cazeneuve points out that these camphor compounds are probably more numerous than is generally supposed (*Jour. Phar. Chim.*, July 15, p. 49). Even resin and gum resins are said to soften in contact with camphor, and gutta percha has been reported to behave similarly. Although in many of these cases true compounds are probably formed, in which the individual properties of the constituents are modified, the exact nature of the combination has not yet been explained, and it is evident that it is comparatively feeble. It is known, for instance, that upon submitting to distillation the liquid formed by the combination of camphor with chloral hydrate, it is split up into its constituents. The same result is obtained by simply shaking it with water; but it remains unaltered when agitated with aqueous solution of chloral hydrate. In discussing the question, M. Cazeneuve expresses the opinion that the formation of these compounds is not due to the non-saturation of the camphor molecule, which allows of the fixation of two atoms of hydrogen, to form borneol, because the compound so produced is a stable one. He prefers to consider camphor chloral and its congeners as a class of "molecular compounds," in which the combination between the two constituents is comparable to that which exists between water of crystallization and a salt.

The Ruin of a Gas Plant.

The effect upon the gas works at Johnstown, Pa., by the flood was thus described by *Light, Heat and Power:*

"The works are completely demolished, the only thing left being the brick holder tank. Of the three main brick buildings, there is not only 'not one brick left upon another,' but not any bricks left at all. They are out of sight, washed down the river.

"The stack of benches was razed to the ash pans, the hydraulic main carried bodily a block away, while the retorts, or what is left of them, are scattered over several acres.

"Of the Granger water gas plant, the generators and superheaters were toppled over and fell through to the cellar, the condenser was carried a block to the west, while the scrubbers and washers have totally disappeared.

"The station meter was carried south several hundred feet, while the storage oil tank was deposited in a meadow at Bolivar, *twenty-three miles* down the valley.

"At the time of the flood (4 P. M.) both gas holders were full. They and the columns were carried bodily to the stone bridge, over which they careened and collapsed among the wreckage of the Cambria Iron Company's plant, three-fourths of a mile from the gas works.

"The gas property looks like a strip of river bottom, nothing but a waste of sand and tree trunks. Sighting across the holder tank walls, one sees nothing; so completely was it razed that the cast bases of the holder columns are the highest points. The tank is sound, excepting a few feet of the coping and top wall, and is filled with sand. The station meter and the shells of the water gas plant are practically uninjured."

A Plan for Getting Rid of Mosquitoes.

Robert H. Lamborn has placed in the hands of Morris K. Jesup, of the American Museum of Natural History, New York, the sum of $200, to be paid in three prizes of $150, $30, and $20, for the three best essays on the destruction of mosquitoes and flies by other insects. It is suggested that the dragon fly is an active, voracious, and harmless "mosquito hawk," and that it might, if artificially multiplied, diminish the numbers of the smaller insects. A practical plan is called for in the breeding of the dragon fly or other such destroyer in large numbers, and its use in the larva, pupa, or perfect state, for the destruction of mosquitoes and flies in houses, cities, and neighborhoods.

Mortgage—Machinery—Real Estate.

The Supreme Judicial Court of Massachusetts held, in the recent case of the Southbridge Savings Bank vs. Mason, that as between mortgagor and mortgagee all machinery necessary to the business for which a building was erected, resting upon stone foundations laid as a part of the construction of the building especially for their support, or for the accommodation of which places were fixed in the floors, as well as other very heavy machinery fastened to the building or resting in position by its own weight, would be held to be part of the real estate.

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THE PARIS EXHIBITION.

PARIS, August 10, 1889.

A very interesting item that embodies what is attracting a good deal of attention from mechanics, and is conceded to be a new, useful, and ingenious idea, is the employment of wire brushes to start machinery in motion without a violent shock or arrest its motion quietly and easily. It is the invention of a Frenchman, and is shown applied to a pulley to impart motion, as stationary brushes to arrest motion, and as a practical application to a 100 horse power dynamo, but this latter was not running when I saw it. As applied to a pulley and clutch motion, it is shown in Fig. 1, representing a ring brush made of wire of about the same size and length as that of the brushes used in iron foundries to clean castings with, and studded just about as thickly. This brush is fastened to the arms of the pulley, whose hub is recessed for a clutch arm, the pulley being capable of sliding along its shaft. Upon the shaft to be driven there is fixed a wheel, in the figure, with teeth like a crown gear wheel, the teeth having about ⅝ inch pitch. Upon the brush being brought to bear in the teeth, even to a slight depth, the hold is surprisingly great—more than a man can pull. The pulley exhibited is about 17 inches in diameter, and with a brush grip of ⅛ inch deep, I should think it would take a pull of three or four hundred pounds on the rim to make the brush slip. Another part of the exhibit is a heavy weight (say 250 lb.) that is fired off from a compressed strong spiral spring, and is assisted under a length of six inches by passing between two brushes that catch its sides. There are many applications for which this invention will prove a perfect boon, more particularly, however, for transmitting rotary motion. The inventor does not seem to have thought of its employment in the place of spur or bevel gearing, and yet there are doubtless such cases in which it might be profitably used.

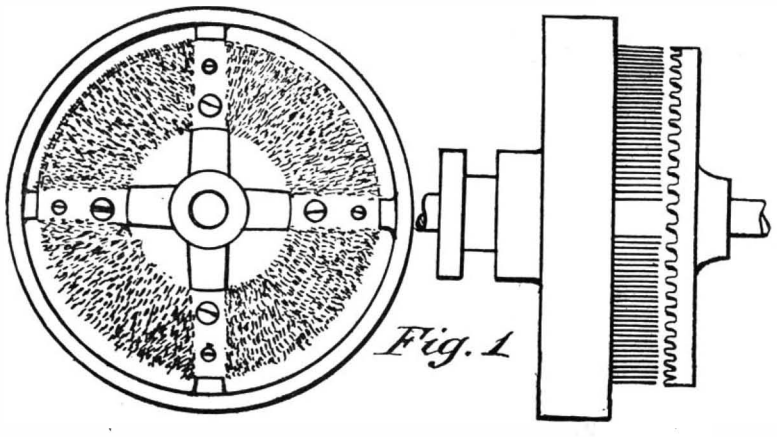
Fig. 1

In examining a wood-boring machine the other day, I came across a chuck for driving augers that is a good thing in its way and that ought to be better known than it is. Fig. 2 is a vertical view of it, A being the end of the spindle of the machine, and B a cap screwing on C. is a steel pin, and D an auger shank with a flat place on it for the end of the pin, C. As B is screwed upon A, it forces pin C down on the auger shank and holds it firmly. Besides the simplicity of this chuck, there is the advantage that it requires no wrench or key to work it, hand pressure being quite sufficient.

On a French stationary engine there is a pulley that attracts quite some attention on account of its construction as well as its great size. Its arms are made of wrought iron riveted up as in Fig. 3, and are a very neat-looking job indeed. The diameter of the wheel is about 35 feet and the width of face about 6 feet. Inside the rim is an internal gear having a pitch of about 4 inches and a 3 inch face, the engine driving the pinion for this gear. Of course the object of the wrought iron arms is to decrease the weight, as well as to avoid the shrinkage strains that might cause a wheel with cast iron arms to fly into pieces. It will not be out of place here to remark that the French and Belgian stationary engines are fine pieces of mechanism. The whole of the Belgian exhibits reflect the highest credit on that country. As might be expected, there is a good deal of similarity between the French and the Belgian designs, when we come to go into the little details, and, as might be expected, Germany cuts a very poor figure in the machinery department.

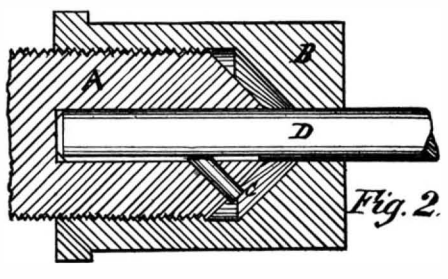

Fig. 2.

A very interesting exhibit to railway engineers is of the Feraud system of suspension for railway carriages. Neither rubber springs nor spiral springs find any favor for railway cars either in England or France, the ordinary leafed spring being used exclusively. The ordinary method of suspension of these springs is shown in Fig. 4, and the improved method in Fig. 5. In the former the brackets, *a*, are outside the springs and in the latter they are within the length of the spring, and the result is that the elasticity of the improved spring is, from its mode of suspension, about twice as great as it is in the ordinary methods. In either case it will be seen the brackets, *a*, descend vertically and the outer ends of the spring get closer together as the spring bends out of the straight line. Now, in the case of Fig. 4, as the spring deflects, the movement of the links, *c*, is in an arc of a circle that varies considerably from the path of motion of the end of the spring, whereas in Fig. 5 the paths of motion of both the end of the spring and the links, *c*, are in the same general direction, and it is the fact of there being no antagonism of motion, as it were, that so greatly increases the ease of motion and elasticity of the spring. This is an excellent example of how much improvement may be made by a close study of details and of not taking it for granted that a thing must be made right because everybody makes it that way. The inventor is sure to make a fortune from this invention, simple as it is. He has in his exhibit not only models showing the superiority of his mode of suspension, but also an appliance for recording, by means of diagrams, the elasticity of springs under the various conditions of shape and points of suspension.

JOSHUA ROSE.

Our Foreign Commerce.

For the last fiscal year the value of imports of merchandise amounted to $745,127,476, as against $723,957,114 during the fiscal year 1888, an increase of $21,170,362.

The exports of merchandise amounted to $742,401,799, as against $695,954,507 during the fiscal year 1888, an increase of $46,447,292.

The increase of our exports was mainly in the following articles: Cotton (raw), provisions, animals, wood and manufactures of, mineral oils, iron and steel, and manufactures of cotton. The increase of imports was mainly in the following: Coffee, sugar, wool, and manufactures of hides and skins, seeds, hemp, and silver ore. There was a decline in the imports of iron and steel, vegetables, and manufactures of cotton.

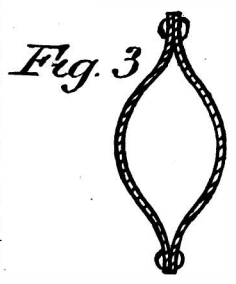
Fig. 3.

The value of exports for the year was greater than any other year since 1883, and was only exceeded by the exports of 1881, 1882, and 1883. The value of imports was the greatest in the history of our commerce, exceeding our exports by $2,725,677.

Our exports of gold and silver amounted to $94,641,533, our imports to $28,963,073, an excess of exports of $67,678,460. The number of immigrants arriving during the year was 438,614, as against 539,815 for 1888, a decrease of 101,201.

The Austrian Sugar Industry.

Our readers are aware the beet sugar industry has attained great perfection in Austria, hence we trust that the following facts, gleaned in part from the "Commercial Archives" in Germany, etc., will prove of interest. Austro-Hungarian beet factories are of several kinds, the difference in the working being due to their geographical location; in some cases the production is only for domestic consumption, in others for exportation to England, Holland, etc. A great number of the factories under consideration are stock companies, where the owners of the stock do not supply the beets. Some factories are worked by a system of small stockholders, where no one owns more than two shares, valued at thirty dollars each, and the capital is hundreds of thousands of dollars. In such cases there is great difficulty in bringing about harmony between the numerous stockholders; the interests of the farmer and manufacturer result in discord.

On the other hand, in Germany, the stockholder and farmer being one and the same individual soon appreciates that it is to his interest to cultivate rich beets. For complicated reasons, too long to discuss in this writing, the co-operative system has not met with the success in Austria it has in Germany. Nevertheless those factories working on important estates have been very profitable to all interested. The existing system of taxation is said to be one of the very best in Europe, and the prospects for a constantly increasing production never looked more favorable than at present. The proof of this assertion is the fact that many new factories are building in Hungary. The refining business, which has not had much encouragement hitherto, has now a promising future; this will evidently result in an important export to the Orient.

Respecting the system of taxation doing so much good, we would say that it is upon sugar, only when it is consumed, with direct bounty for exportation.

It is evident that the manufacturer can, under these circumstances, dispose of a greater capital, and ameliorate the farming condition of the estate. The cost of manufacturing sugar in Austria-Hungary is very low, labor may be had in abundance, and the wages are small. A curious fact is that notwithstanding the success of the sugar industry in the country, the value of lands is less than in France or Germany. In Bohemia an acre of ground suitable for beet cultivation is worth $250, and only $140 in Hungary. Women and children work in the fields for 8 to 14 cents per day, while the hands at the factory receive 24 to 32 cents.

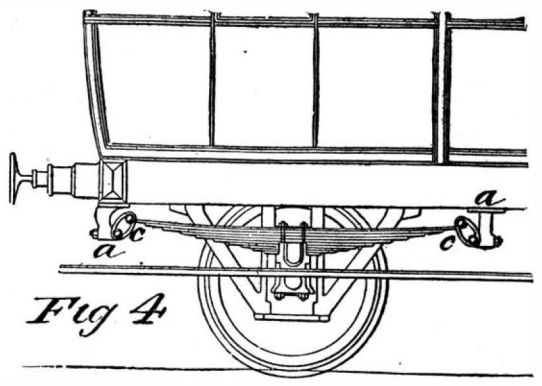

Fig 4

On a model Bohemian farm the cost of working land cultivated in beets was $38.40 per acre; this includes working of the soil, chemical fertilizer (saltpeter), beet seed, thinning out, interest of capital, etc. The leaves and their value are not considered—the beets thus cost $3.20 per ton (including the interest on value of land).

The cost of manufacturing sugar at these factories was $2.40 per ton of roots worked, and in some special cases $1.80 when 100 lb. sugar were extracted from 900 lb. beets. The cost per pound would be about two cents. Sugar for the home consumption is made in 56 factories, of which 11 are refineries; of the 45 remaining, about one-half refine the sugar made in the factory and the other half refine sugar purchased from outside factories.

Of late years the exportation of refined sugar from Austria has become very important. Hamburg, as a shipping center, appears to offer many advantages. Trieste is also one of the important shipping ports. It must be said respecting the latter that the French have of late years offered considerable competition from Marseilles.—*The Sugar Beet.*

To Keep Iron Pipes from Rusting.

A simple and economical way of tarring sheet iron pipes to keep them from rusting is the following, suggested by a correspondent of the *Gas Light Journal:* The sections as made should be coated with coal tar and then filled with light wood shavings, and the latter set on fire. It is declared that the effect of this treatment will be to render the iron practically proof against rust for an indefinite period, rendering future painting unnecessary. In proof of this assertion the writer cites the example of a chimney of sheet iron erected in 1866, and which, through being treated as he describes, is as bright and sound to-day as when erected, though it has never had a brushful of paint applied to it since. It is suggested that by strongly heating the iron after the tar is laid on the outside, the latter is literally burned into the metal, closing the pores and rendering it rust proof in a far more complete manner than if the tar itself was first made hot and applied to cold iron, according to the usual practice. It is important, of course, that the iron should not be made too hot, or kept hot for too long a time, lest the tar should be burned off. Hence, the direction for the use of light shavings instead of any other means of heating.

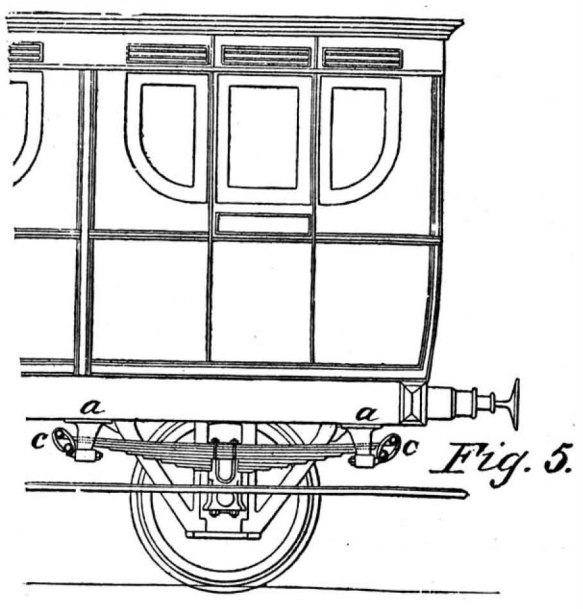

Fig. 5.

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RECENTLY PATENTED INVENTIONS.

Engineering.

VALVE GEAR.—Emil Kaselowsky, Karl Gramm, and Gustav Kurbitz, Berlin, Germany. This is an improved valve gear for multiple-cylinder engines, designed to effect the supply and discharge of the steam by double piston valves free from pressure and worked from a single inclosed eccentric carrying several eccentric rings, each ring serving to operate only one piston slide.

FUEL GAS GENERATOR. — John R. Peters, Georgetown, Pa. The fuel receptacle has a hollow air-supplying frame inclosing spaced perforated pipes whereby air may be delivered through and around the entire mass of incandescent fuel, the action being continuous and producing at a low cost a uniform product of gas suitable for puddling or welding iron, melting steel, glass, etc., pulverized bituminous coal being used, with which water or hydrocarbons may be introduced.

Railway Appliances.

CAR COUPLING.—Hiram D. Layman, Little Rock, Ark. In this coupling the drawhead has its lower portion formed with a guide incline, and its upper portion extended in advance thereof, forming a bumper, in combination with a pivoted link, adjusting bail, coupling pin, and latch, whereby meeting cars may be readily made to couple, but will not couple automatically in shifting about in a car yard.

FISH PLATE AND JOINT. — John N. Valley, Jersey City, N. J. This invention relates to an improvement especially adapted for use in connection with elevated, cylindrical, or square railroad rails, the plate and joint beingsimple, durable, and comparatively light, while affording a firm and solid bearing for the rail.

ELEVATED RAILROAD. — John N. Valley, Jersey City, N. J. This invention relates to rail joints and supports especially adapted for use with elevated railways, providing simple and durable means for uniting the abutting ends of rail sections, and effective means of tying the rails to the structure and bracing them, the invention consisting in the novel construction of the plate and its combination with the rail lug, and in the details of the device for connecting the rails and fish plates.

Mechanical.

PRINTING MACHINE.—James Farmer, Salford, Lancaster County, England. This is a machine for printing linoleum, floor cloths, and textile fabrics, and also applicable for embossing. It has a reciprocating carriage carrying tables, one reciprocating vertically above the other, the upper table supporting a printing block, and this table being connected with a crank shaft whereby a compound reciprocating motion is imparted to the tables.

MACHINE FOR REDUCING RAILS. — William Scholl and Theodore G. Wolf, Scranton, Pa. Combined with rollers are guards and side guides held on the guards, the latter conforming to the shape of the rail, and both guards and guides leading to the rollers, making a strong and simple machine for rerolling and reducing old steel rails from a larger to a smaller cross-section without lapping or welding.

FORMING TEETH FOR RASPS.—Philip S. Stokes, Freehold, N. J. This invention covers a process of forming the teeth upon rasp blanks by starting the point of each tooth by an initial blow delivered upon the punch, the blow being accurately gauged to the same force or power for each tooth, and then lifting the body of each tooth by subsequent blows on the punch, accurately gauged to the same force for each tooth, whereby the teeth are made uniform.

Agricultural.

HARROW.—Samuel Rothchild, Pendleton, Oregon. This invention covers an improvement in harrows which have fixed or stationary teeth and teeth which revolve, the invention consisting in certain novel constructions and combinations of parts.

ANCHOR FOR HAY PRESSES. — Mills McCulla, Milford, Iowa. This is a power anchor for portable presses and other machines operated by horse power, whereby stakes are dispensed with and the anchor is in a measure effected automatically according to the movement of the frame produced by he draught on different sides.

Miscellaneous.

SOLAR WATER LIFTING APPARATUS.—Alva L. Reynolds, Elsinore, Cal. This is an apparatus in which the expansion and contraction of air is utilized to raise water automatically from deep wells, etc., consisting of a cylinder having a heating chamber provided with lenses, a piston cylinder, a chamber behind the heating chamber with weighted bellows on its top, and other novel features.

WINDMILL.—Rollin Worsley, Newark, Ill. By this invention the wind wheel shaft is mounted to turn, and is made in two parts universally jointed together, the frame being mounted to swing and made in two parts hinged together in line with the universal joint, the construction applying more particularly to a windmill without vane or rudder to hold its face to the wind, and running back of the tower or pivot.

FAUCET.—Al. R. Brandly, New York City. This invention covers a novel construction and arrangement of parts whereby, when the vessel into which the faucet is to discharge is placed in position to receive the discharge, the valve will be thrown from its seat, and when the vessel is withdrawn a spring will act to close the valve.

BOLTING REEL. — Cyrus T. Hanna, Pittsburg, Pa. This is a flour bolt in which the reel is provided with a circular series of longitudinally disposed and spaced buckets, each wedge-shaped in cross section and having a rib projecting from the carrying surface of one bucket toward the narrow edge of the next, whereby specking is prevented and the material is kept in contact with the cloth from the under side of the reel to the top.

ARTIST'S WET CANVAS CARRIER. — Frederick D. Sutton, New York City. This device consists of opposing clamp plates having spacing strips for separating two canvases, with a strap or binding device, and a handle at one of the clamp plates, whereby two wet canvases of the same or different sizes may be conveniently carried without danger of marring their freshly painted faces.

BANNERMAN'S PHENYLE.—Charles F. Bond, Chicago, Ill. This is the copyrighted name of a disinfectant, deodorizer and germicide, to be used in sick rooms and wherever foul and disagreeable odors arise, the compound consisting of slaked lime, red ocher, carbolic acid, creosote, bichloride of mercury, salicylic acid, and other ingredients mixed and united in specified proportions.

FOUNTAIN PEN. — John D. Bray, Montreal, Quebec, Canada. This invention covers an improvement on a formerly patented pen of the same inventor, in which a compressible bulb is employed for regulating the flow of ink, and resting when the pen is in use against one of the fingers of the writer, the improvement giving complete control over the ink not only during writing, but when the pen is not in use, while the separate cap covering the outer end of the feeder is dispensed with.

SCIENTIFIC AMERICAN

BUILDING EDITION.

AUGUST NUMBER.—(No. 46.)

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1. Elegant plate in colors of a cottage for twelve hundred dollars. Perspective elevation, floor plans, page of details, etc.
2. Plate in colors showing perspective elevation and floor plans for a small frame cottage to cost one thousand dollars. Page of details, etc.
3. Page engraving of the new and elegant Trinity church at Tiffin, Ohio, designed by F. K. Hewitt, architect.
4. A New England mansion. W. B. Tubby, New York, architect. Perspective elevation and floor plans.
5. Elevation in perspective and floor plans of a cottage at Jersey City Heights. Cost twelve thousand dollars.
6. A cottage recently erected at Bridgeport, Conn., at a cost of two thousand three hundred dollars. Floor plans and perspective.
7. A handsome country residence at Belle Haven Park, Greenwich, Conn. Cost eleven thousand dollars. Perspective and floor plans.
8. A house for eight thousand dollars, recently erected at Bridgeport, Conn. Perspective view and floor plans.
9. The New United States court house and post office, Charleston, S. C. Cost three hundred thousand dollars. Perspective and plans.
10. A cottage at Bedford Park, New York. Cost three thousand five hundred dollars. Plans and perspective.
11. House for three thousand six hundred dollars, recently erected on Armory Hill, Springfield, Mass. Perspective elevation and floor plans.
12. Page of designs of ornamental well curbs.
13. Brick dwellings recently erected in Jersey City, N. J., at a cost of three thousand eight hundred dollars each. Plans and perspective.
14. A corner residence on Jersey City Heights, N. J. Cost eighteen thousand dollars. Plans and perspective.
15. The great chapel, cathedral of Toledo, Spain drawn by Antonio Hebert. Full page engraving.
16. Engraving of the Lessing theater in Berlin.
17. View of the new electrical labratory of Purdue University at La Fayette, Indiana.
18. View of the street front of the handsome Brooklyn, N. Y., library.
19. Miscellaneous Contents: Hints to architects.—Iron bricks.—Hard woods.—Prevention of diphtheria.—Overthrowing a chimney.—The manufacture of Roman bricks.—Woods for inside finish.—Jim Fisk's monument.—Experiments on mortar and concrete, with illustrations.—Clamp for pulling street piling, illustrated.—The Eiffel tower.—Sixteen stories the limit.—A singular fireplace explosion. — An ornamental stairway, illustrated.—The Hess system of ventilating and warming.—Hints about lawns.—Hot water heating, illustrated.—The "Timby" automatic sash lock, illustrated.—A solid guaranty for roofing plates.—High speed automatic engines.—Metallic shingles and roofing tiles.—Electrical appliances for houses, illustrated.

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Wanted—A young or middle aged man to take charge as foreman in erecting department of machine shop engaged in building stationary and automatic engines in Southern Pennsylvania. Pay, $18 per week; no lost time, and extra for overtime. Must be familiar with valve motions and know how to set them, and would prefer one who understands the indicator. Permanent employment to a competent, energetic man. Send references and state age. One who has had experience preferred. Intemperate men need not apply. Address, "Foreman," P. O. box 773, New York.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1209) W. R. M. asks: 1. Can you tell me a way to kill grass on a tennis court? I have cut the grass off close to the ground, and want to destroy the roots. I have heard that spreading salt will serve. Can you help me? A. Salt, if used in sufficient quantity, will be efficacious. A solution of chloride of lime or bleaching powder will be still more so. After applying the latter the ground should not be used until after some days of exposure and rain. 2. Have you at any time published anything on tennis, or tennis courts? A. You will find the subject of forming lawns, treated in the SCIENTIFIC AMERICAN, vol. 50, page 228, and elsewhere in it and in the SUPPLEMENT. For laws of lawn tennis, we refer you to the SCIENTIFIC AMERICAN SUPPLEMENT, No. 301.

(1210) A. P. H. asks: What will take hardened shellac from clothing? Alcohol seems insufficient. A. We know of nothing better than alcohol. Use the purest, and soak the spot for several hours. Cover up so that the alcohol will not evaporate.

(1211) J. F. M. writes: Steam is conveyed from engine house to our sanitarium, about 100 feet distant, in pipes inclosed in a wooden box filled with sawdust. One pipe at 5 pounds pressure for heating and another at 40 pounds for the laundry. The wooden box caught fire, which I claim originated from one of the steam pipes. Others claim that such was impossible. Which is right? A. This is no doubt a case of spontaneous combustion from moist sawdust. Sawdust has been known to take fire in boxes when in the proper condition of moisture without external heat. Pulverized charcoal, asbestos, or mineral wool is much safer for covering or insulating steam pipes.

(1212) C. E. G. asks: 1. What is potential energy? A. The power of doing work due to advantageous position or other similar factor. Thus a clock spring wound up possesses potential energy, a ten pound weight raised ten feet has imparted to it one hundred foot pounds of potential energy. If allowed to fall freely, it would attain at the end of its course, on account of its weight and velocity, kinetic energy equal to the same amount. 2. What is meant by the conservation of energy? A. That the sum of the energy of a system is always the same. Energy cannot be annihilated, it can only change its form, as from potential to kinetic, from heat to mechanical or chemical, and so on through all the forms of energy.

(1213) N. S. C. writes: 1. A recent number of the *Sanitary Volunteer*, in giving advice concerning the care of the hair, says: "It is very beneficial to clip the ends of the hair once a month, after it has been brushed smoothly down the back. After this all the forked ends that remain should be clipped, as while in this condition there will be no growth." Now, I maintain that clipping the end of a long hair, burning it or doing anything else to its outer extremity, cannot possibly have any influence on the growth at the scalp, either as regards rapidity or healthy condition. Am I right? A. The length of hair certainly has a very great influence on its growth. Hence it is reasonable to suppose that clipping the ends will accelerate growth. It seems doubtful if forking of the ends will entirely arrest growth. 2. If a hole were made completely through the earth, passing through the center, and a stone were dropped in it, would it come to a state of rest as soon as it reached the center, or would it oscillate through a constantly decreasing amplitude and finally come to rest? How would the presence or absence of a resisting medium (the atmosphere) affect its behavior? A. The ball would oscillate back and forth. If there were no resisting medium it would do so forever. Air or its equivalent would bring it to rest. 3. Could a storage battery be charged by means of a dynamo running at low speed, say, one hundred revolutions a minute, the time of the operation supposed, of course, to be proportionately extended? If not, why? A. The E. M. F. of the dynamo must be about 2½ volts per cell to be charged. If this could be obtained at the low speed, the charging would take place.

(1214) A. McN. A. asks: 1. What are the constituents of gasoline oil as made from petroleum and shale? A. Gasoline consists largely of olefines and paraffines. 2. How many cubic feet of pure gas, free from air, will one gallon produce? A. 70 to 100 cubic feet. 3. How many parts of air are required for perfect combustion? A. It depends on the heat at which it has been produced, about 15 parts by volume. 4. What is the heat of its flame in F. degrees? A. This depends on its many factors—about 2,000° F. 5. What is its boiling point under 760 mm.? A. Gasoline boils at 115° Fah. 6. How many mm. of mercury will its gas support if produced in a close container at 56° Fah.? A. Under pressure the denser constituents will settle, but considerable hydrogen, marsh gas, etc., will remain uncondensed. 7. Are there any good works treating of oils in general? A. Crewe's Petroleum, which we can supply for $5, is excellent.

(1215) D. S. H. asks: 1. Are there any magnetic insulators, and what are they? A. None properly speaking. A plate of iron, by causing the magnetism to react upon itself, acts as such to a certain extent. 2. I want to pump 20 cubic feet of water into a tank 100 feet above ground (no matter what size pipe is used). Now, the motive power of the pump is a weight decending 60 feet, and when the weight reaches the ground, the water will all be in the tank. Now, how heavy would the weight have to be? A. You have to do 125,000 foot pounds of work, therefore with a fall of 60 feet your weight would have to be 2,083 pounds, making no allowance for friction.

(1216) E. R. W. writes: Could you give me a receipt of any kind whereby I could make rubber adhere to wood? I have a number of small hard wood rollers which I would very much like to cover with a coating of rubber one-sixteenth inch thick, so that it would be smooth all round (just as though it was turned in a lathe). I see that it can be made to adhere to metal, as the clothes wringer, etc., but am somewhat in doubt how it can be done upon wood. A. You can vulcanize the rubber in place, but we suggest the use of thin ready made India rubber tubing such as is cut up into bands. This can be procured of various sizes and can be drawn over the wood and cemented.

(1217) E. E. T. writes: Please explain why some animals can see in the dark while others cannot? A. No animal can see in the dark. Some have eyes extremely sensitive to light of low intensity. Such can see in places which we pronounce dark, but there must be some light present.

(1218) E. P. S. asks for the formula for the substance used in cleaning marble, such as tombstones, etc. A. Various formulæ are used. Two parts washing soda, 1 part ground pumice stone, and 1 part finely pulverized chalk may be used, mixed to a paste with water. Rub well over marble and wash off with soap and water.

(1219) R. H. S. asks (1) for a scientific explanation of what takes place in soldering tin, where you use zinc dissolved in muriatic acid for a flux. A. The explanation is not easily reached. The chloride of zinc seems to dissolve greasy dirt and oxide of tin and lead, so as to bring the two metals together without any intervening film. It also probably modifies the surface tension of the solder, just as solution of mercuric chloride does that of metallic mercury. 2. How to make chloride of zinc. A. Dissolve zinc in muriatic acid to saturation, filter, and evaporate to dryness. 3. How can I make aquaammonia? A. Treat any ammonia

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salt in a retort with solution of caustic soda, boil off the ammonia, and collect in water in a proper apparatus. The retort must have a guard tube to prevent back flow of the water.

(1220) F. B. writes: 1. There exists a difference of opinion with regard to graphite, plumbago, and blacklead. While one party says they are three different names for the same material, others believe there are three different minerals. Which is correct? A. They are all the same—three names for one material. 2. Are lead pencils pure graphite or a preparation? A. The higher grades are pure graphite. 3. What is stove polish made from? A. From graphite.

(1221) E. S. writes: If a circle whose radius is equal to a be placed upon a larger circle so that the circumference of the smaller shall rest upon the diameter of the larger and leave the uncovered portion of the larger just equal to the area of the smaller, what is the method of determining the radius of the larger circle? A. The area of the small circle is $p\,a^2$ (p=3·14159 . . .). The area of the large circle is to be $2p\,a^2$. Let x=radius of large circle, then we have $2p\,a^2=px^2$ $x^2=2a^2$ or $x=\sqrt{2a^2}$. Thus if the radius of the small circle is 1, the radius of the large one will be $\sqrt{2}$ =1·41 . . .

(1222) W. L. D. is referred to our SUPPLEMENT, No. 479, for a description of the Eads Tehuantepec ship railway.

(1223) G. G. writes: 1. Do you know of any legitimate use to which old or canceled stamps could be put? I have heard people speak of money being offered for a certain number. A. It is said that the Chinese purchase them in China for making papier mache. 2. How far can any one be understood distinctly through the telephone spoken about in the SCIENTIFIC AMERICAN, May 18, 1889, page 307? A. One or two hundred yards.

(1224) A. D. K. asks: What preparation can I use to render wood impervious to kerosene oil, and how applied? A. Apply a thin solution of glue while hot. A little glycerine, about 5 per cent in weight of the dry glue, may be added.

(1225) W. E. M. writes: I want to reduce some carbon plates to a granulated form, and at the same time want the granulated particles to be bright and shiny, so that when you rub them in your hand they will not black or crock the hand. A. You will not succeed in getting good results. Pound and screen your carbons. You will do better with selected lumps of gas carbon, as it approaches the graphitic modifications.

(1226) F. M. writes: Will you inform me through the SCIENTIFIC AMERICAN the number of United States vessels, and their names and classes, or let me know how I can find out about them? A. For the new vessels see the SCIENTIFIC AMERICAN, May 18, 1889, page 308.

(1227) J. H. asks where he can get an electric power to drive about 200 or 300 pounds on wheels, which could be put in as small a space as possible. I want to attach the same to a vehicle, and run it thereby. A. The storage battery with any of the standard motors comes the nearest to your requirements. The problem you propound is not fully solved as yet.

(1228) T. C. asks: In making jams and preserves what chemicals are the best to use to prevent fermentation, and in what proportions? A. A very small amount of salicylic acid is effectual, about 1-1000 or less may be used.

(1229) O. L. S. asks: 1. What kind of gas is best for inflating balloons? A. Hydrogen. 2. What is the lifting power in pounds of such gas, say 100 cubic f et? A. 7 pounds. 3. Will double the quantity of gas lift twice the weight, or more? A. Twice the weight. 4. Does not comp essing the gas decrease its lifting power? A. Yes.

(1230) Aspirant.—We recommend, and can supply by mail, "Elementary Lessons in Electricity and Magnetism," by S. P. Thompson, p ice $1.25, also "Electricity for Public Schools and Colleges," by W. Larden, price $1.75.

(1231) F. J. M. asks how to make a transpar nt com osition which will be stiffer than mica but not so easily broken as glass? A. Use celluloid if there is no danger of combustion.

(1232) B. L. P. Co. asks: What cheap substance will retard the setting of plaster of Paris (other than glue) by mixing in a dry state or by calcining with raw plaster? A. We would suggest grinding with it after or before calcination quicklime, from ten per cent upward.

(1233) L. G. writes: Can you suggest to me any scent or perfume that will effectually mask or kill the odor of benzine, of an equally volatile nature? A. Deodorize the benzine by treatment with a mixture of 1 part sulphuric acid, 1 part water, and as much bichromate of potash as will dissolve in it. Or distill from quicklime, rejecting first and last portions of distillate. We cannotsuggest a perfume that will overcome the odor.

(1234) J. P. writes: Can you state a good formula for the two compositions for safety matches? A. For match heads the following compositions are used:

	a	*b*
Chlorate of potassium	2,000	2,000
Binoxide of lead	1,150	2,150
Red lead	2,500	2,500
Trisulphide of antimony	1,250	1,250
Gum arabic	670	670
Paraffin	250	250
Bichromate of potassium	1,318	

Rub the paraffin and antimony together, and then add to other ingredients. Enough water is added to bring the mass to a proper consistency when heated. Conduct heating operations on a water bath. The sticks are first dipped in a solution of paraffine in benzine and then are dried. For striking surface, mix 9 parts red phosphorus, 7 pulverized iron pyrites, 3 pulverized glass, and 1 of gum or glue, with water q. s. 2. Also how the same can be made practically water or damp proof? I have had a good deal of trouble in the present wet spell in lighting the ordinary parlor matches. I have a Swedish "safety" match, the heads of which do not come off after long soaking in water, while the heads of common matches soon disintegrate with like treatment. A. If in match head formula glue is used instead of gum arabic, and operations conducted in a darkened room, a practically waterproof head will be obtained. 3. I have also a Swedish match which, when blown out, the fire entirely disappears instantly, leaving no burning ash; besides, the burnt or carbonized part is quite firm and will not drop on the floor. How are those results produced? A. Soak the sticks in phosphate of soda and dry perfectly before treatment.

(1235) T. W. L. asks for a good copper or brass polish in powder form. A. Tripoli and rotten stone can be crushed to a fine powder, and are largely used for polishing. For a high polish, use rouge.

(1236) L. M. H.—What oil is used to oil the slide of a slide trombone? A. Watch oil, to be procured from a watchmaker's establishment, is the best.

(1237) S. C. asks: 1. Who invented the cable car? What year and what city first used? A. The cable or wire rope system for street railways was invented by A. S. Hallidie, and was first operated in San Francisco in 1873. See SCIENTIFIC AMERICAN SUPPLEMENT No. 298 for its illustration. 2. Is it known why the satellites of Uranus move different (or retrograde) from the moons of the other planets? A. The position of the planes of the orbits of the satellites of Uranus and Neptune and their apparent retrograde motion is one of the departures from the uniformity of motion in the solar system not yet accounted for by astronomers; possibly, if La Place's theory be true, the long ages since the outer planets were thrown off from the solar ring has increased the chances of disturbance in the position of their planes of rotation by outside influence. 3. Which planet has the greatest dip in its orbit? A. Mercury has the greatest dip or inclination to the ecliptic, viz., 7° 0′ 7″·71.

(1238) C. D. asks: 1. How much horse power will it require to run a screw-cutting lathe which swings 11 inches on face plate? A. ⅛ to 3 h. p., according to the work to be done. 2. What is the average pressure of the Croton water in the mains in New York city north of the Harlem River? A, 15 to 30 lb. per square inch, according to elevation.

(1239) C. H. M.—Use fusible alloy, which melts in boiling water, for casting medal work in plaster of Paris. Make it by mixing 1 part lead, 1 part tin, 2 parts bismuth. Melt the lead and tin together, then add the bismuth.

(1240) C. H. B.—The theory in regard to propelling balloons by air, compressed or otherwise, looks well, but the mechanical difficulties are very great.

(1241) S. G.—The melting points of the following metals are: Gold 2,300°, silver 1,900°, copper 2,000°, cast iron 2,300°, lead 608°, tin 446°, zinc 680°, nickel 2,800°, mercury 39°, platinum 3,300°.

(1242) A. L. E. asks: 1. A solution to put on brass optical instruments to give them a dull black color? A. Use platinum chloride solution for black on brass. 2. How is it that the images which are inverted upon the retina appear to us right side up? A. Because we are accustomed to see them inverted from infancy.

(1243) M. M. C.—Hair and horn melt at about 350°, but must be kept from the air, as they become crisp by losing a volatile constituent. Know of no work treating upon this subject.

(1244) H. W. asks: 1. A method of filling and polishing white and light colored woods without changing their natural color. A. There is an excellent article of wood filling made and on sale in most markets, which preserves the natural color. Paraffin makes a good filler for light colored woods that are not required to have a hard finish. If a hard surface is required, use bleached shellac dissolved in pure alcohol. Fill, dry, and rub down with the finest sandpaper, and varnish with the white shellac made thin with alcohol, or with white mastic varnish. 2. What is the best method of salting and packing white fish and lake trout? A. Thoroughly cleaning as soon as possible after the catch, dry with a cloth lightly and pack closely in suitable boxes or kegs with fine salt, dry, in sufficient quantity.

(1245) "Advance" asks: Would the eight light dynamo as described in the SUPPLEMENT work as well if the field magnets were wound with eight continuous layers of wire, *i. e.*, instead of two layers continuous, as there are four of these, making eight layers, would not the one continuous winding do, if the dynamo was intended to be run always as a shunt machine? A. The continuous winding will answer if you intend to always use the machine shunt wound. 2. What number German silver resistance wire, and how much, to use in the shunt to give the required 20 ohms resistance? A. The resistance of German silver wire varies somewhat, but it is about ten times as great as that of copper. You should make your resistance variable. 3. What is meant by the machine will run 25 volt lamp (16) two in parallel, does it mean 16 25 volt, 16 c. p. lamps, or 25 volt 8 c. p. A. Lamps are connected in parallel when all of the terminals at one side of the lamp are connected with one of the circuit wires, and all of those upon the opposite side are connected with the other circuit wire.

(1246) L. R. S. asks how a billiard cue tip can be kept on the cue, in our very moist atmosphere. (Charleston, S. C.) We have used the regular preparation, and coachmaker's glue, and even stratena, without success. A. Try bicycle tire cement, or a mixture of asphalt, and ¼ its weight of gutta percha clippings, melted together at a low heat. Or try sealing wax melted up with a little beeswax if it is too brittle.

(1247) C. C. J. writes: Can you give me any information as to "Pimaric acid"? It is produced from pine wood. I should like to know how it is best made, its chemical formula, and if it can be extracted from turpentine? A. It is made from the turpentine of the *Pinus maritima* of Bordeaux, France. Its formula is $C_{20}H_{30}O_2$. You cannot obtain it from common turpentine in any quantity, as that yields colophony, which is principally an isomeric acid called sylvic or abietic acid.

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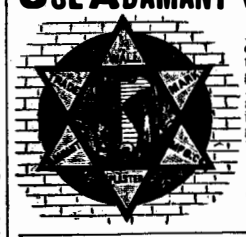

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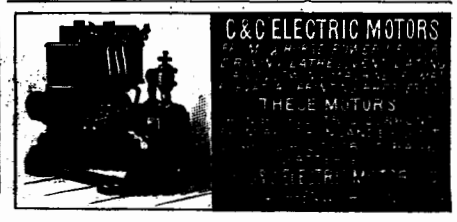

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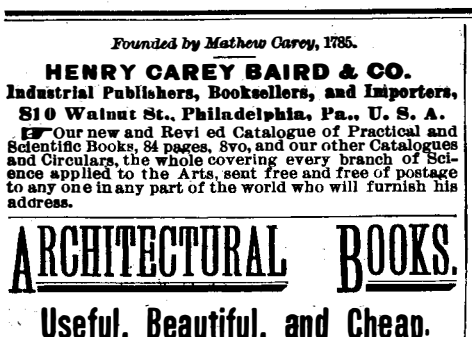

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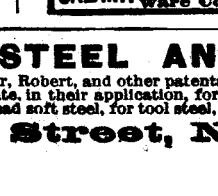

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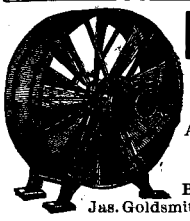

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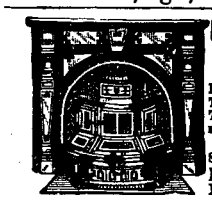

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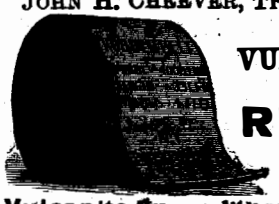

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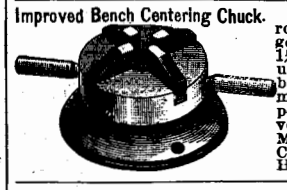

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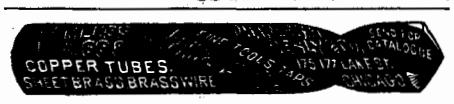

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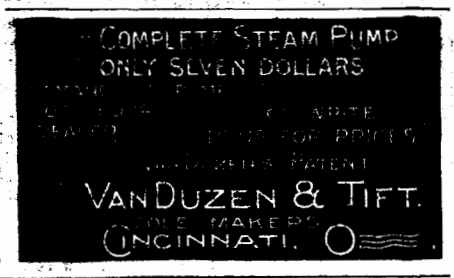

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